LAND USE PLANNING
FOR SALMON, STEELHEAD AND TROUT:

A land use planner's guide to
salmonid habitat protection and recovery

October 2009

Aquatic
Habitat
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Program

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CHAPTER ONE
INTRODUCTION

1.1 Why This Guidance

The Washington Department of Fish and Wildlife (WDFW) is providing this guidance on planning for salmon, steelhead and trout (also known as salmonids) to help integrate local land use planning programs and state salmonid recovery efforts. This planner's guide to salmonid recovery is intended for local government planners and includes information on state salmonid recovery efforts, sources of scientific guidance and model policies and development regulations.

The focus of this guidance is on naturally spawning salmon, steelhead and trout because these species are at-risk of extinction. Over one hundred populations of salmon and steelhead have been listed as threatened or endangered in Washington State under the federal Endangered Species Act (ESA) (Good et al. 2005), and at least seven salmon stocks are already extinct in Puget Sound (Brennan and Culverwell 2004). To recover salmonid populations, Washington has multiple efforts underway including the development and implementation of regional recovery plans. Yet regional salmon recovery plans are often disconnected from local land use planning initiatives.

It is Washington State's goal to: "restore salmon, steelhead and trout populations to healthy harvestable levels and improve those habitats on which fish rely." - Washington State Joint Natural Resources Cabinet (GSRO 1999)

Incorporating the information provided in this guidance into local land use planning and decision-making is an important step towards reaching the goal of recovering naturally-spawning salmonid populations. Approximately 54% (23.4 million acres), of land in Washington State is privately owned (IAC 2001) and mostly regulated by local government planning programs. Much of this land includes low-lying areas where salmonid habitat is prevalent, such as floodplains and river deltas. Upland development activities also impact this habitat. Therefore, land use decisions implemented at the local level affect salmonid recovery efforts and protection strategies.

Salmonid habitat includes in-stream physical characteristics (e.g., temperature, water quantity, structure, substrate conditions, pool/riffle ratios, etc.), but habitat is strongly influenced by watershed processes beyond the waterline, including canopy cover, riparian condition, large woody debris recruitment, impervious surfaces and stormwater discharge, sediment delivery, water allocations (withdrawals), road location and maintenance, watershed hydrology, and nutrient dynamics. Therefore, planning for salmon, steelhead and trout must address the condition and extent of water-related resources as well as upland processes that influence aquatic habitat.

The intent of this guidance is to assist local governments working on comprehensive updates to Growth Management Act (GMA) and Shoreline Management Act (SMA) planning programs and related regulatory and incentive-based programs. The GMA and the SMA are the two most significant state laws governing local land use planning decisions to protect critical salmonid habitat. The GMA requires special consideration be given to conservation or protection measures necessary to preserve or enhance critical anadromous fish resources. The SMA requires no net loss to fish and wildlife conservation areas which includes anadromous fish habitat. To address these requirements, this guidance provides science-based management recommendations in the form of model policies and regulations. These recommendations can be incorporated into local GMA and SMA planning programs including critical area ordinance updates under the GMA and shoreline master program updates under the SMA.

1.2 Relationship to Other Guidance

WDFW has previously published sources of scientific information and recommendations to protect and recover salmonid habitat. These include the Pacific Salmon and Wildlife technical report (Cederholm et al. 2000), Statewide Steelhead Management Plan (WDFW 2008), and nearshore (Envirovision et al. 2007) and riparian management recommendations (Knutson and Naef 1997). These reports, as well as other best available science (BAS) for anadromous fish resources provided by the Washington State Department of Commerce (formerly Department of Community, Trade and Economic Development) (WDCTED 2003), provide local governments with numerous scientific resources related to salmonids. These existing sources of information are referenced throughout this new guidance document.

Due to the breadth of scientific information already available to help local governments provide special consideration for salmonids, this guidance document focuses primarily on how planning policies and regulations can incorporate the science. More specific language tailored to local circumstances may be necessary. WDFW regional biologists or habitat consultants may be able to assist in fine-tuning the general policy and regulatory recommendations to local circumstances. Appendix A provides sources of science, habitat management recommendations and other relevant resources, including contact information for WDFW staff.

1.3 How to Use This Guidance

This introductory chapter describes the purpose and need for this guidance and provides an overview of salmonid recovery planning in Washington state and the relationship of salmonid recovery to land use planning. Chapter Two provides an overview of salmonid ecology, including habitat functions and potential habitat impacts associated with land use activities. This summary of salmonid ecology is written for the non-biologist and is not meant to provide an exhaustive review of the scientific literature. The literature cited should be consulted for additional scientific information.

In Chapter Three the relationship of salmonid recovery to land use planning is discussed in greater detail. This chapter is organized by planning tools designed to manage development impacts to salmonid habitat. Each planning tool includes a table of model policies and regulations, local example policies and regulations, and planning resources. The model policy and regulatory recommendations are meant to inform land use plans and codes, while the examples offer an existing local approach to address salmonid recovery in land use planning programs.

Additional resources for land use planners related to salmonid recovery planning in Washington State can be found in the appendices. Appendix A includes resources such as partners in salmonid recovery planning, management recommendations and habitat mapping resources. Appendix B includes a list of definitions for terms used in this document; these definitions can also be used to inform local policies and regulations.

1.4 Salmonid Recovery in Washington State

Salmon, steelhead and trout are in the family *Salmonidae*, and referred to collectively as salmonids[1]. Some salmonids are anadromous, meaning that they spawn in freshwater, but reside in both freshwater (including lakes, rivers, streams, as well as wetlands) and saltwater (including estuary and open ocean) environments for at least some portion of their lifetime. However, some species exhibit a higher propensity to reside wholly in freshwater.

In this document, a greater emphasis is placed on migrating salmonids that rely on freshwater and saltwater environments because these fish combine high value to people (food, recreation, cultural importance), high value to ecosystems of the state (they support a vast array of species in fresh and salt water from orca whales, sea lions, and seabirds to otters, eagles, herons, and insects), and sensitivity to their environment (water quality, water quantity, food source, habitat structure and access).

Salmonids indigenous to the State of Washington that are currently listed under ESA are provided in Table 1.1. Within each species there is Evolutionary Significant Units (ESU) or Distinct Population Segments (DPS)[2] that are defined by regional geographic extent and genetic differentiation. For example, populations that are reproductively isolated from each other such as Upper Columbia spring-run Chinook and Upper Columbia fall-run Chinook are in separate ESUs. For additional information on federally ESA listed fish species by ESU/DPS in Washington State visit:
http://wdfw.wa.gov/fish/management/esa/federally_listed_esa_fish.pdf.

[1] Salmonids include federally listed native char, commonly known as Bull Trout or Dolly Varden.
[2] For a complete definition of Evolutionary Significant Unit or Distinct Population Segment, see Appendix B, Definitions.

Table 1.1: ESA[3] Listed Pacific Salmonids in Washington State

Common/*Scientific* Name	**ESU/ DPS**	**Federal Listing**
Chinook Salmon/ *Oncorhynchus tshawytscha*	Puget Sound	Threatened
	Upper Columbia River Spring Run	Endangered
	Snake River Fall Run	Threatened
	Lower Columbia River	Threatened
	Snake River Spring Run	Threatened
	Snake River Summer Run	Threatened
Chum Salmon/ *Oncorhynchus keta*	Hood Canal Summer Run	Threatened
	Columbia River	Threatened
Coho Salmon/ *Oncorhynchus kisutch*	Puget Sound/Strait of Georgia	Candidate
	Lower Columbia River	Threatened
	Southwest Washington	Candidate
Sockeye Salmon/ *Oncorhynchus nerka*	Ozette Lake	Threatened
	Snake River	Endangered
Steelhead (Rainbow Trout)/ *Oncorhynchus mykiss*	Middle Columbia River	Threatened
	Puget Sound	Threatened
	Snake River Basin	Threatened
	Upper Columbia River	Threatened
	Lower Columbia River	Threatened
Bull Trout/Dolly Varden/ *Salvelinus confluentus*	Coastal-Puget Sound	Threatened
	Upper Columbia River	Threatened
	Middle Columbia River	Threatened
	Snake River	Threatened
	Touchet/Walla Walla[4]	Threatened
	Lower Columbia River	Threatened
	Olympic Peninsula	Threatened
	Northeast Washington	Threatened
Coastal Cutthroat Trout/ *Oncorhynchus clarki clarki*	Southwest Washington/ Columbia River Coastal	Candidate

For salmonid populations to achieve recovery and ultimately a delisting, the ESA requires the federal government to develop recovery plans. The ESA is concerned with the extinction risk faced by an entire ESU. Therefore, NOAA-Fisheries

[3] The ESA defines "Endangered" as any species which is in danger of extinction throughout all or a significant portion of its range; "Threatened" includes any species which is likely to become endangered within the foreseeable future throughout all or a significant portion of its range.

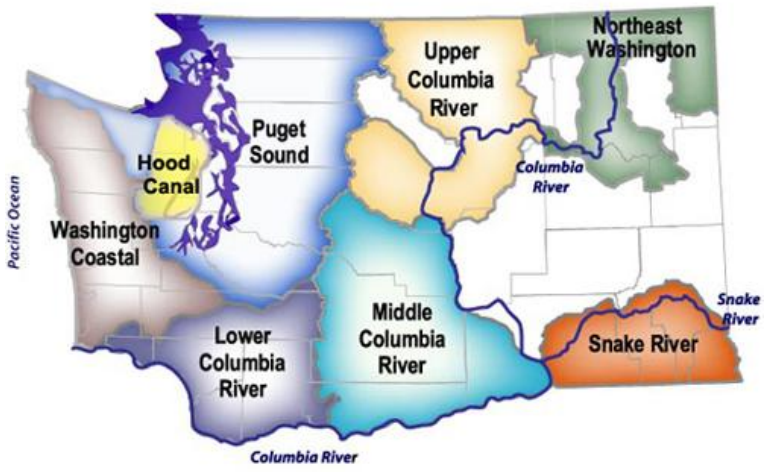
[4] Oregon Recovery Unit

(NOAA-F)[5] has determined that such recovery plans need to be prepared at an ESU scale, or regional basis. The plans are to integrate actions necessary in habitat, harvest, hatcheries, and hydropower, and gain commitments to retain and recover salmonid populations at risk of extinction (NMFS 2007). This guidance focuses on habitat because local government planning decisions influence the recovery and protection of salmonid habitat. For information on WDFW management of harvest, hatcheries and hydropower, please visit: http://wdfw.wa.gov/fish/management/salmon_conservation/21st_css/index.html.

1.5 Salmon Recovery Plans

In Washington State, regional recovery boards have been formed to coordinate the development and implementation of regional salmon recovery plans. Recovery plans are an important resource for local planners regarding listed

Figure 1.1: Salmon Recovery Regions in Washington State



Graphic courtesy of Governor's Salmon Recovery Office

salmonids and priority habitat recommendations in their region. Recovery plans include watershed profiles as well as lead entity strategies (http://www.rco.wa.gov/srfb/leadentities.htm) to guide on-the-ground

[5] The Fisheries Division of the National Oceanic and Atmospheric Administration (NOAA) has jurisdiction over anadromous fish listed under the ESA. Trout and whitefish are under the jurisdiction of the United States Fish and Wildlife Service.

restoration and acquisition projects and work plans to implement projects at the watershed scale. The regional recovery plans are available at: *http://www.governor.wa.gov/gsro/regions/recovery.asp* (links are provided to each regional recovery board below). Six regional recovery plans have been adopted by NOAA-F: Upper, Middle, and Lower Columbia River, Snake River, Puget Sound, and Hood Canal.

Washington Coastal. The Washington Coastal Salmon Recovery Region includes all Washington river basins flowing directly into the Pacific Ocean and includes all or portions of Clallam, Jefferson, Grays Harbor, Mason, Thurston, Pacific, and Lewis counties. The federally listed salmonids in this region are Lake Ozette sockeye and bull trout, both listed as threatened. More information available at: *http://www.wcssp.org*.

Puget Sound. The Puget Sound Salmon Recovery Region is the largest in the state and comprises all or part of 12 counties including Whatcom, Skagit, Island, San Juan, Snohomish, King, Pierce, Thurston, Mason, Kitsap, Jefferson, and Clallam. The Puget Sound Salmon Recovery Region includes the Puget Sound Chinook and steelhead Evolutionarily Significant Unit (ESU), identified by the NOAA Fisheries as well as Lyre/Hoko drainages (Water Resource Inventory Area 19). Puget Sound Chinook, steelhead, and bull trout are listed as threatened. More information available at: *http://www.psp.wa.gov/SR_status.php*.

Hood Canal. The Hood Canal is located within the Puget Sound Salmon Recovery Region, but has a separate salmon recovery plan for Hood Canal. It includes portions of Jefferson, Mason, Clallam, and Kitsap Counties. Puget Sound Chinook, Puget Sound steelhead, Hood Canal summer chum and bull trout are listed as threatened. More information available at: *http://hccc.wa.gov/*.

Lower Columbia River. The Lower Columbia River Salmon Recovery Region encompasses five counties in Southwest Washington. This Region includes Clark, Cowlitz, Lewis, Skamania, and Wahkiakum, and portions of Pacific and Klickitat counties. Chinook, coho, chum, steelhead, and bull trout are listed as threatened. More information available at: *http://www.lcfrb.gen.wa.us/default1.htm*.

Middle Columbia River. The Middle Columbia River Salmon Recovery Region includes salmon bearing streams in Benton, Kittitas, Yakima, and parts of Chelan

and Klickitat counties. Steelhead and bull trout are listed as threatened in this region. More information available at: *http://www.ybfwrb.org/*.

Upper Columbia River. The Upper Columbia River Salmon Recovery Region includes salmon-bearing streams in Chelan, Douglas, and Okanogan counties. Spring Chinook, steelhead and bull trout are listed as threatened. More information available at: *http://www.ucsrb.com/*.

Northeast Washington. The Northeast Washington Recovery Region includes salmon bearing streams in Ferry, Lincoln, Pend Oreille, Spokane, and Stevens counties. There is no official recovery board in this region; recovery strategies are coordinated by the Pend Oreille Lead Entity, the Kalispell Tribe (see Appendix A for information on the role of Lead Entities). Bull trout are listed as threatened. More information available at: *http://www.pocd.org/2496.html*.

Snake River. Snake River Salmon Recovery Region includes salmon-bearing streams in Walla Walla, Columbia, Garfield, Asotin, and parts of Franklin and Whitman counties. Sockeye, Chinook, steelhead and bull trout are listed as threatened. More information available at: *http://www.snakeriverboard.org/.*

1.6 Salmonid Recovery and Land Use Planning

Managing development of urban and suburban areas, industrial, residential and business uses, as well as resource lands are assumed to be the primary activities of local government land use planning programs. Because local government growth management and shoreline management plans regulate many of the land use decisions in these areas, local governments are in a unique position to influence the protection and restoration of salmonid habitat.

Areas of rapid urban growth tend to occur near water resources, such as Puget Sound or the Columbia River basin, where the terrain is easier to develop. These lowland areas provide a majority of the freshwater and marine/estuarine habitat available to salmonids. Therefore, development in these areas can result in a dramatic loss of habitat.

In order for salmonid recovery to become a reality, it is necessary that local governments adopt policies and rules specific to salmonid recovery and protection in their land use planning programs.

Agricultural and forest lands have the potential to preserve important habitat and watershed processes for salmonids, if carefully managed. But, agricultural production and forest practices can harm salmonid habitat if best management practices are not implemented. For example, agricultural production that allows animal access to waterways can result in bank erosion and nutrient loading thus harming water quality and salmonid habitat structure. Forest practices can also impact salmonid habitat in freshwater tributaries where streams can become clogged with sediment or fish are unable to access natal streams or important spawning areas due to poorly installed culverts at forest road crossings.

Voluntary restoration and protection projects are a key element of regional recovery plans, but voluntary projects alone will not be able to keep pace with development impacts, particularly given the current rate of growth that Washington is experiencing. Washington State has grown by nearly one million people in the last decade, bringing the total population to over six and a half million.[6] A growing population has altered land cover resulting in increased urbanization and a greater demand on resource lands including existing agricultural and forest lands.

Voluntary restoration and acquisition projects also demand extensive funding and coordination to purchase land, conservation easements and/or implement habitat improvements. For example, restoring a reach of shoreline to its natural function requires multiple steps to obtain funding and implement construction/restoration activities to restore salmonid habitat functions. Cumulative impacts from multiple shoreline armoring projects that removed shoreline vegetation and disrupted sediment supply to the beach likely reduced or eliminated forage fish spawning areas (an important prey species) and vegetative shading, food supply and cover (Envirovision et al. 2007). Steps necessary to achieve a restored condition could include the purchase of properties in whole or in part, deconstruction and removal of bulkhead materials and associated fill stabilizing the site by replanting native vegetation, and restoring natural beach grade by adding sediment and large wood. Furthermore, it may take several years to achieve full function after initial restoration actions are implemented. Thus it is less costly to protect sensitive areas than it is to repair them once damaged (May et al. 1996).

[6] Washington State Office of Financial Management, 2008 Population Trends. http://www.ofm.wa.gov/forecasting/key2pop.asp.

The recommendations in this guidance are intended to support voluntary and incentive-based approaches to land use planning for salmonids, as well as to assist local governments with meeting planning and salmon recovery laws. As stated earlier, land use decisions made by local governments significantly influence salmonid habitat. Comprehensive planning programs provide an opportunity to prioritize critical salmonid habitat areas and designate appropriate land uses consistent with recovery plan priorities. Local permitting programs under the zoning ordinance, critical areas ordinance and shoreline master program provide an opportunity to regulate development to protect critical salmonid habitat. Incentive programs, such as transfer of development rights or open space tax programs provide an opportunity to protect sensitive salmonid habitat from development. Recommendations addressing all of these aspects of local planning are provided in the guidance.

CHAPTER TWO
PACIFIC SALMONIDS AND LAND USE

2.1 Salmonid Ecosystem Interactions

The ecological impacts of salmonids are far-reaching. These organisms have variable life stages that connect them to the ecology of many aquatic and terrestrial consumers. They have an indirect relationship to the entire food web and play a crucial role in supporting overall ecosystem health (Cederholm et al. 2000). Over 137 species of birds, mammals, amphibians and reptiles use salmonids for one or more stages of their life, preying on eggs, juvenile and adult salmonids (Cederholm et al. 2000). Many species also feed on salmonid carcasses, including terrestrial and aquatic insects, which then become food for young salmon (Gende et al. 2002).

Salmonid influence on watershed processes also includes biofeedback. Carcasses decomposing in a riparian system fertilize soils and promote faster growing trees around streams and lakes (Fresh 2006). Increasing vegetative production provides more trees for large woody debris recruitment which in turn provides cover, spawning, and rearing habitat for salmon.

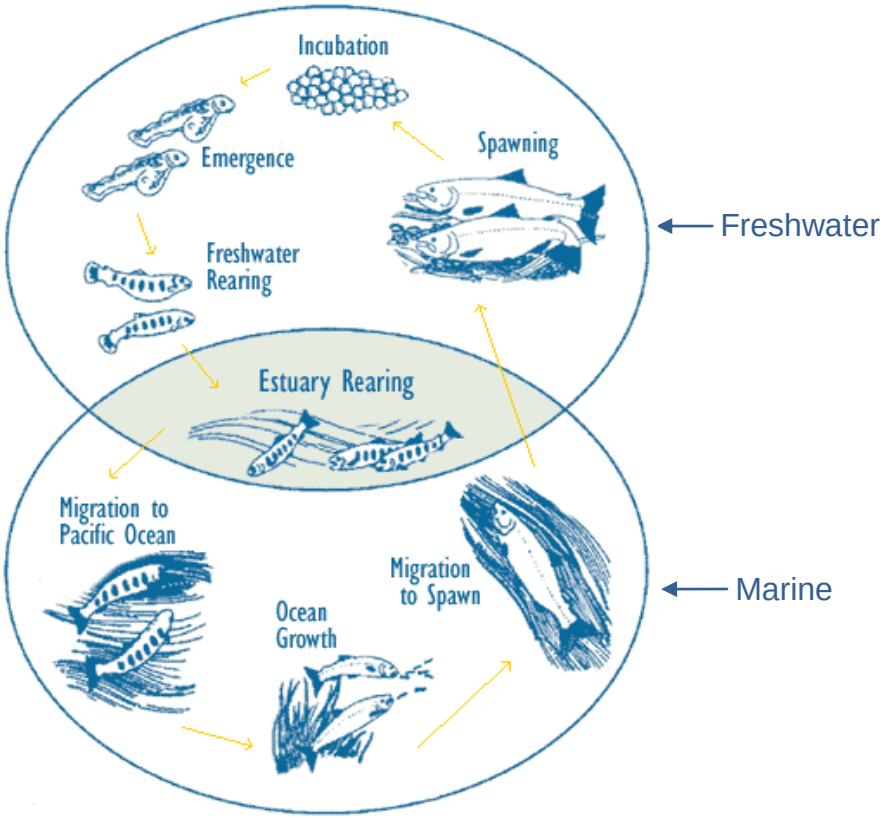
Because of their contribution to the productivity of the entire watershed, salmonids are considered a “keystone species” (Quinn 2005). A keystone species is extremely important because it plays a critical role in ecosystem health, having a disproportionate influence on other species (Kauffman et al. 2001). It is unknown how far the impacts of losing salmonids in watersheds would go, but it is likely there would be far-reaching impacts on all natural resources.

2.2 Anadromous Fish Life Stages and Habitat

Salmonids are also considered an umbrella species because they require large blocks of relatively natural or unaltered habitat to maintain viable populations in freshwater and saltwater environments throughout their life. The life stages of anadromous salmonids are shown in Figure 2.1. The stages include spawning and egg incubation, freshwater rearing, seaward migration, open ocean rearing, return migration to freshwater to spawn and the deposition of marine derived nutrients into the freshwater ecosystem (Cederholm et al. 2000). Survival of

anadromous salmonids depends upon their ability to occupy and move among freshwater, nearshore and open ocean habitats (Fresh 2006).

FIGURE 2.1 Anadromous Fish Life Stages



Graphic courtesy of Washington Department of Fish and Wildlife

Salmonids have evolved with diverse life history trajectories allowing them to exploit interannual variation in conditions. For example, within the same river system Chinook salmon juveniles may migrate directly to sea as fry, migrate to the delta and rear for months before moving to sea, migrate to the nearshore but move into subestuaries for rearing, or remain in the river system for months before migration to sea (Fresh 2006). Therefore, it is important to retain healthy habitat in a variety of habitats to allow exploitation of a variety of different life history trajectories and spatial structure (McElhany et al. 2000). Following is an overview of salmonid life stages.

2.2.1 Freshwater Spawning. Spawning and egg incubation occurs in freshwater where females construct a nest, or redd. Redd site selection is influenced by physical variables, such as stream depth, velocity, and substrate size (sand, gravel, etc.). The shallow downstream ends of pools leading to riffles contain loose gravels the product of size-dependent sediment transport and deposition following erosion upstream. Female salmonids use their tail to clean away sand and silt before depositing eggs into excavated pits (Cederholm et al. 2000). The eggs are fertilized by one or more males before the female covers them with more gravel. Habitat structure such as large woody debris found in many streams increases the habitat complexity by creating areas with different depths, velocities, substrate types and amounts of cover, and adds stability to the redd during winter floods . In general, spawning salmonids avoid the slowest water with fine sand and silt; avoid the fastest water; and prefer water about 30-60 cm deep, flowing about 30-100 cm per second over coarse sand and small to medium gravel (2-10 cm in diameter). These conditions allow a high flow of oxygenated water through the interstitial spaces in the streambed, bringing cool, well-oxygenated water to the redd and carrying away metabolic waste (Quinn 2005). If temperature and flow conditions are suitable, the eggs will hatch as alevin in 19-150 days. Alevin initially stay inside the redd substrate and require the same habitat functions, cool temperatures and flow to provide well-oxygenated water and carry away metabolic waste. Mortality of eggs and alevin in redds is often associated with suffocation from excessive silt, heat stress from elevated temperature regimes (particularly in spring and early summer), and excavation of the redd during winter storms (Bjornn and Reiser 1991).

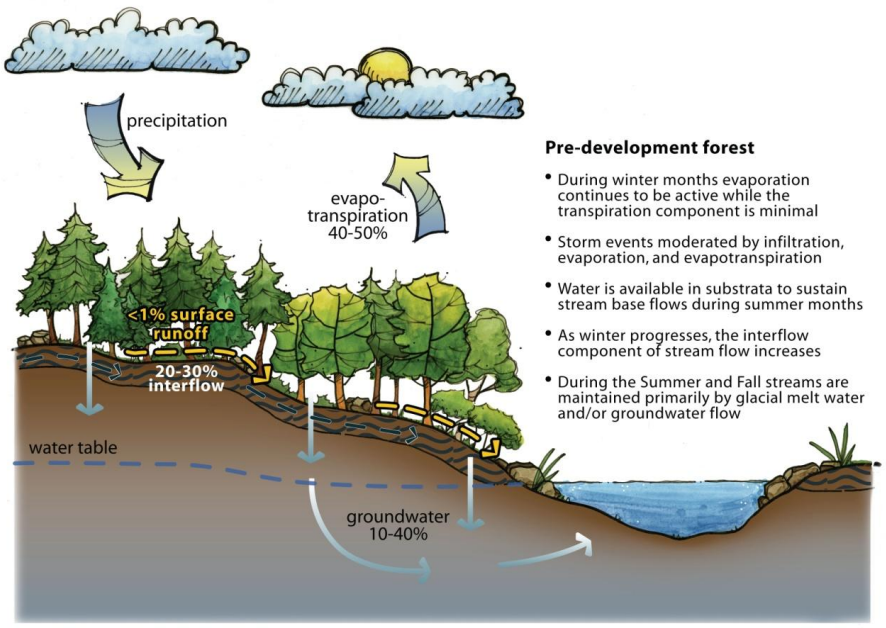
Photo 2: Coho Salmon Spawning

2.2.2 Freshwater Rearing. Freshwater rearing continues as the fish develops from an alevin to a fry. At this stage they feed on a variety of aquatic and terrestrial insects[7] and often seek refuge in low-velocity areas such as side

[7] Larger juvenile salmonid (parr) may supplement their macroinvertebrate diet with occasional salmonid eggs or fry (Cederholm et al. 2000).

channels, oxbows, floodplain wetlands (NMFS 2008), in pools below riffles, behind large woody debris or boulders, undercut banks, or on the margins of streams. Large woody debris or boulders create local variations in flow because water speeds up adjacent to the obstacle and the water is slowed on the leeward side creating pools. These in-stream features allow juvenile cutthroat trout, steelhead and larger salmon to occupy low velocity locations in the channel to conserve energy while feeding from the relatively higher velocity areas carrying food. Likewise, off-channel areas provide energy-efficient territories for rearing salmonids, especially coho, with good winter feeding conditions and a place to avoid high flows and turbidity of main rivers (Cederholm et al. 2000).

Figure 2.2 Natural Hydrologic Regime



Graphic courtesy of AHBL, from the LID Technical Guidance Manual for Puget Sound, 2005, Puget Sound Partnership and Washington State University Extension.

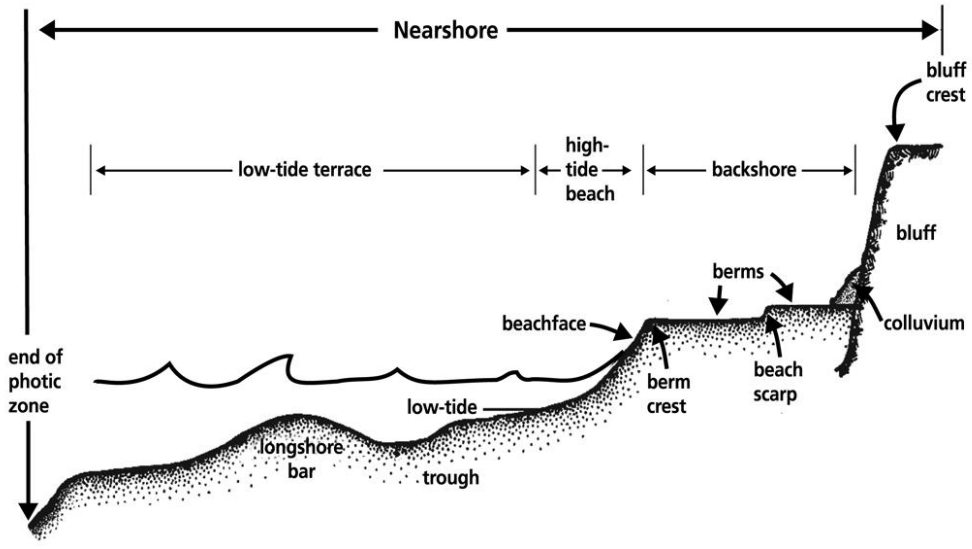
The mix of in-channel and hydraulic features that shape freshwater rearing habitat extends beyond the waterway. Upland areas provide key habitat in the freshwater environment as natural terrestrial vegetation provides food source (insects), cover and large woody debris recruitment. Upland native vegetation also contributes to erosion control and temperature control and filters pollutants and sediment that run off impervious surfaces (see Figure 2.2).

Photo 3: Coho Freshwater Rearing

2.2.3 Nearshore: Marine and Estuarine Habitat. The physical, chemical, and biological processes that create nearshore habitats are critical to salmonids survival (Fresh 2006). Figure 2.3 shows the nearshore zone, which includes the photic zone, the maximum depth offshore where sunlight is sufficient to support

Figure 2.3 Nearshore Zone

Cross-section of a beach with terminology used in the Puget Sound area



Graphic courtesy of Johannessen and MacLennan 2007 modified from Komar 1976

plant growth, as well as the shoreline and upland and backshore areas that directly influence shoreline conditions (Envirovision et al. 2007). Nearshore areas that are not significantly affected by freshwater inputs are considered nearshore "marine" habitats (Buchanan et al. 2001) and the nearshore also extends upstream to estuaries and bays where freshwater and marine waters converge (Envirovision et al. 2007).

Commonly, within a year or two, all anadromous salmonids migrate downstream to estuaries. The amount of time spent in the transition zone of estuaries varies. Estuaries provide important feeding areas (due to food abundance and diversity), refuge from predators, and a place for growth before entering the ocean (Simenstad et al. 1982; Cederholm et al. 2000). Species such as Chinook, pink and chum rely heavily on the estuary for foraging, growth, and physiological transition between freshwater and saltwater (smolting), while others may reside in the estuary and feed and head back up the stream for another season (Cederholm et al. 2000).

Photo 4: Natural Shoreline Habitat

After migrating through their natal estuaries and deltas, juvenile salmonids forage for food in nearshore marine habitats on their way to the open ocean. Within the Puget Sound, exposed, cobble, or gravel beaches appear to be preferred nearshore marine habitats for salmonids (Simenstad et al. 1982). Nearshore food webs support abundant prey types especially important to juvenile salmonids including a wide variety of aquatic and terrestrial invertebrates, and forage fish including herring, sandlance, surf smelt, and anchovy. All marine and estuarine nearshore habitats are occupied by forage fish (Pentilla 2007).

Near marine shorelines, juvenile salmonids seek refuge from predators in eelgrass and macroalgae (kelp and marine alga) (Williams and Thom 2001; EnviroVision et al. 2007). Other nearshore features that may reduce predation on juvenile salmonids include high levels of turbidity, presence of shallow water habitat, and abundant and diverse prey resources that sustain high growth rates

and allow juvenile salmonids to rapidly outgrow many of their predators (Fresh 2006).

Upland vegetation provides similar habitat functions in the nearshore environment as in freshwater riparian areas (Brennan and Culverwell 2004). Shoreline terrestrial vegetation provides food source (insects), cover and input of large woody debris and filters pollutants and sedimentation from impervious surface runoff. All these habitat components of the nearshore support a gradual transition between estuarine and marine waters which is an energy intensive process for salmonids.

2.2.4 Ocean Residence. Salmonids may spend between one to five years and travel great distances in the Pacific Ocean before returning to their natal streams to spawn as adults. The amount of time spent in the ocean and the migration patterns vary among and within species. For example, anadromous salmonids will always migrate to the ocean and return to spawn before dying, whereas the resident phenotype of *Oncorhynchus mykiss* (rainbow trout) does not migrate to the ocean. In addition, both steelhead and rainbow trout can spawn multiple times in a lifetime (Cederholm et al. 2000).

Chum and pink salmon migrate seaward shortly following emergence from the gravel, going directly to the estuaries and the ocean, spending very little time in freshwater, whereas some races of stream-type Chinook and almost all coho salmon may remain in freshwater for at least one or two years before smolting and migrating seaward (Simenstad et al. 1982). Sockeye salmon rear almost exclusively in lakes as juveniles and may remain for one or two years before smolting and steelhead often remain for at least two years and sometimes as many as five to seven years before migrating seaward.

Once salmonids reach the open ocean they forage opportunistically on a diverse assemblage of marine organisms (Cederholm et al. 2000). However, ocean habitat components are beyond the scope of this guidance document.

2.2.5 Return Migration. After one to five years, salmonids are prompted to return to freshwater environments to spawn by internal physiological changes, temperature changes, length of day, and barometric pressure, among other

Photo 5: Chum Return Migration

environmental triggers (Quinn 2005). Adult salmonids find their way back to their natal streams for spawning using olfactory cues imparted by chemical odors emanating from individual watersheds and tributaries (Bjornn and Reiser 1991; Quinn 2005). The return migration requires a reverse transition from saline to freshwater environments which again occurs in estuarine nearshore environments. If natal stream habitat has been degraded in the time these fish have been away in the open ocean, spawning success may be impaired or eliminated.

2.3 Habitat Functions

Although the habitat requirements of each species of anadromous salmonid differ somewhat, all share some common habitat needs to support life stage development (Spence et al. 1996). Common habitat functions include:

- a stable incubation environment (flow regime/water quantity),
- cool, well-oxygenated, unpolluted water (water quality),
- cover (habitat structure),
- sufficient sources of prey (food source), and
- unimpeded access to off-channel areas and saline waters (access).

2.3.1 Flow Regime (Water Quantity). Flow patterns affect salmonid survival due to the close inter-relationship between the fish and its stream (May et al. 1996; Spence et al. 1996). The amount, location and timing of water flow is a product of (1) climate (how much water falls when and whether it is frozen or liquid), (2) gravity acting on water, and (3) resistance from rock, soil, vegetation, and surfaces modified by humans. Not all water flows in channels as streams or rivers; some water seeps into the soil and becomes groundwater. Groundwater may later intersect a channel and provide the vast majority of stream flow in dry seasons.

The amount of flow determines the depth and velocity distribution in a channel; velocity will vary from place to place in a channel even with a constant flow.

Varied depth and velocities are favorable for salmonid habitat, but very high and very low flows can pose a risk to developing eggs, depending on the magnitude relative to the flows at the time of spawning (May et al. 1996; Spence et al. 1996). In a healthy riparian system, natural flood and drought events establish habitat processes such as erosion or sediment input which provide new sediments for spawning and incubation, but does not overwhelm the system.

Land use strongly interacts with water use to affect how much water and velocity is delivered to yield good habitat in streams. Stormwater runoff is an example of how land use practices can alter natural flow patterns. Excessive flow scours fish habitat (especially spawning habitat), delivers pollutants and pathogens, and brings excess nutrients to surface waters during wet weather (May et al. 1996). Increased flows can fill up spaces between rocks with fine sediment, resulting in decreased oxygen and concentrated waste. Stormwater runoff can also create decreased flows when rain that is routed to streams from impervious surfaces is not routed through groundwater, which can result in low or dry stream reaches and lethal temperature regimes during summer months.

In addition, water allocations for hydropower, irrigation, or municipal/industrial diversion alterations can harm salmonids by changing the amount and type of in-stream flow. For example, peaks in electricity demand influence the timing and volume of hydrosystem releases which can lead to the stranding of adults, juveniles and redds (Spence et al. 1996).

2.3.2 Water Quality (Temperature and Chemistry). Water quality includes temperature, dissolved oxygen, and other dissolved and suspended substances. The most common water quality concerns for salmonid-associated aquatic communities are adequate dissolved oxygen concentration, temperature, pH, and avoidance of contaminants.

Stream temperatures influence egg incubation timing, growth and development, disease susceptibility, movement timing, and survival. The State of Washington Department of Ecology gathered continuous temperature data from a variety of sources and found that in general, during non-spawning and non-incubating times, the temperature should be less than 16-17.5°C (~60-63.5°F) and spawning temperatures should be less than 12.5-14°C (~54.5-57°F) (Hicks 2000). In freshwater temperatures at or above these temperature ranges, salmonids

become lethargic, prone to diseases, lose competitive interactions to other fishes, and become more susceptible to predation (Bjornn and Reiser 1991).

Photo 6: Bull Trout in Clean Freshwater

Water temperature is affected by air temperature, flow regime, riparian vegetation (shade), turbidity, groundwater-surface water interactions, channel complexity, water diversions, substrate composition, the presence of headwater wetlands and lakes, and reservoir releases (May 2003). Many of these conditions and associated impacts are affected by land development practices.

Freshwater temperatures also influence water chemistry. Cool, well-oxygenated water is essential for salmonid survival. Natural streams generally contain an abundant supply of dissolved oxygen (DO) (May 2003). Warmer temperatures increase the metabolic demand for oxygen while the capacity of freshwater to hold oxygen decreases (Quinn 2005). The concentration of DO must be above a critical level (commonly 3 ppm) for salmonids to exist in freshwater streams (Bjornn and Reiser 1991). Embryo dependence on DO peaks just before hatching. Alevins prefer high concentrations of DO and reduced concentrations can adversely affect the swimming performance of salmonids during return migration. Also important to consider is relative water volume; a small polluted stream entering a large river is quickly diluted, perhaps to a level of minimal (although potentially cumulative) impact. The same polluted stream entering a small stream may be devastating to fish and human use.

Photo 7: In-stream Habitat Structure

2.3.3 Habitat Structure. In-stream salmonid habitat includes structures such as boulders and large woody debris that create critical functions such as pools and riffles in streams, and cover from predators in freshwater, estuarine and nearshore environments. Large woody debris (LWD) and boulders dissipate the flow of energy, protect streambanks, stabilize streambeds, store sediments including trapping spawning gravel, and provide natural in-stream cover from predators and habitat diversity for salmonids (Bisson et al. 1987; Crispin et al. 1993; May et al. 1996). Deep areas of pools provide living, holding and hiding space for adult and juvenile fish and can influence the distribution and abundance of juvenile salmonids in streams (Beechie and Sibley 1997; Johnson et al. 2005). LWD also provides surface area on which primary and secondary production occur, providing food for salmonids. Maintaining sufficiently broad riparian zones that allow natural channel migration, flooding and habitat forming processes will ensure trees are available for recruitment to the stream to support salmonid rearing as well as providing resting areas for salmonids as they migrate upstream to spawn (Spence et al. 1996).

2.3.4 Food (Energy) Source. To support life stage development, salmonids require sufficient energy to meet their basic metabolic needs (Spence et al. 1996). In freshwater environments, juvenile salmonids feed on macroinvertebrate stream drift from both in-stream and terrestrial sources. In freshwater and marine systems, as much as 50% of the food resources for salmonids are derived from terrestrial insects falling into the stream or nearshore environment (Brennan et al. 2004).

As salmonids mature and enter nearshore environments, they begin to feed on smaller fish as well as invertebrates. In marine and estuarine areas larger salmonids feed on forage fish, such as sand lance, surf smelt and herring (Envirovision et al. 2007).

2.3.5 Access. Access refers to the return migration of adult salmonids returning to spawn in their native channels. Interference with migration can lead to

reproductive failure and population decline. Migrating upstream demands a great deal of energy and fish need unimpeded access to suitable spawning and rearing habitats. Fish passage barriers, such as improperly designed or maintained culverts, can result in complete barriers blocking all fish migration, temporal barriers delaying access can result in mortality before spawning, and partial barriers that block juvenile or weaker salmonids within a species can reduce genetic diversity (Wofford et al. 2005).

Photo 8: Cutthroat Migrating Upstream

2.4 Land Use and Potential Habitat Impacts

Land use such as urban and rural growth, agricultural production and forest practices can have detrimental impacts on salmonid habitat functions and therefore salmonid survival. However, land use planning can avoid and minimize many of these impacts when policies and regulations integrate salmon recovery plan priorities and include management practices designed to protect and restore salmonid habitat. Management and protection of salmonid habitat includes a special emphasis on stormwater, riparian areas, wetlands, in-stream habitat including large woody debris, floodplains, channel migration, landslide hazard areas, and water quality.

2.4.1 Urban and Rural Growth. Development in rural and urban areas is often located in low-gradient areas within a watershed where riparian systems converge. Urban growth in these riparian environments can alter land surface, soil, vegetation and hydrology by increasing the area of impervious surface. Impervious surface area is strongly correlated with adverse impacts on stream conditions including extensive changes in basin hydrology, channel morphology, and physio-chemical water quality (May et al. 1996; Booth 2000; R2 Resource Consultants et al. 2000). Likewise, loss of forest cover can result in changes to high and low flow

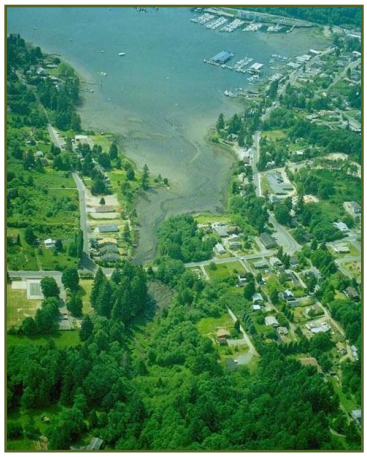


Photo 9: Shoreline Development

frequencies and magnitudes (Chamberlin et al. 1991; Beschta et al. 2000; Grant et al. 2008).

Implementing land use planning for salmon, steelhead and trout can avoid many impacts associated with urban and rural growth by maintaining estuarine, wetland and riparian habitats, and adjacent upland habitats, among others. For example, limiting impervious surface in the watershed and locating development away from riparian systems (using native vegetation buffers) would improve salmonid habitat function and hence survival (May 2003; May 2009). Impervious surface limits and recommendations are discussed in greater detail in Chapter Three (section 3.2.2 stormwater runoff management and section 3.3.1 comprehensive planning).

2.4.2 Agricultural Use.[8] The cultivation of land for agricultural production is also commonly located in low-gradient areas, such as floodplains or coastal estuaries (Kauffman et al. 2001). One of the potential impacts of agricultural production on salmonid habitat functions include the removal of streamside vegetation from excessive livestock grazing resulting in elevated water temperatures and increased fine sediment. Additionally, manure storage and treatment can reduce dissolved oxygen concentrations. These effects

Photo 10: Stream Adjacent to Agricultural Use

[8] In 2007, the Washington State Legislature passed Senate Bill 5248, prohibiting counties and cities from amending or adopting new critical areas ordinance provisions for agricultural activities until July 1, 2010. The law did not change requirements pertaining to critical areas not associated with agricultural activities "nor limit the ability of a county or city to adopt or employ voluntary measures or programs to protect or enhance critical areas associated with agricultural activities." (Senate Final Bill Report SSB 5248) As of the date of publication of this document, the William D. Ruckelshaus Center is facilitating a stakeholder group working on alternative approaches to address potential impacts of agriculture on critical areas. Nothing in this guidance document is intended, therefore, to suggest new critical areas regulations for agriculture. Incentive-based programs and best management practices for agriculture are discussed in section 3.3.7. Under the Shoreline Management Act, new agricultural activities and uses on *non*-agricultural lands can be addressed, but SMPs "shall not require modification of or limit agricultural activities occurring on agricultural lands. In jurisdictions where agricultural activities occur, master programs shall include provisions addressing new agricultural activities on land not meeting the definition of agricultural land, conversion of agricultural lands to other uses, and other development on agricultural land that does not meet the definition of agricultural activities." WAC 173-26-241

are more pronounced in smaller streams. Riparian functions may be further impacted by chemical and nutrient fertilizers, pesticides, and fine sediments from farm runoff (Spence et al. 1996). In some cases, dike construction, stream relocation, and tide gate installation have restricted access to historically important in-stream and off-channel habitats.

Retaining vegetation along waterways through agricultural areas improves water quality by increasing shade, filtering solutes and suspended particles and decreasing bank erosion and manure impacts. Vegetated areas also contribute to salmonid food source by providing leaf litter and insect recruitment as well as habitat structure through large wood recruitment.

Another form of agriculture that can impact salmonid habitat is aquaculture. Aquaculture includes the farming of food fish, shellfish, and other aquatic plants and animals in fresh water, brackish water or salt water areas. Aquaculture activities such as planting and harvesting of shellfish can impact salmonids in marine intertidal waters where eelgrass beds (a critical habitat for juvenile salmonids) may be reduced or damaged (Mumford 2007). Net pen operations in marine waters can increase disease and parasite transmissions to wild salmon and steelhead (Rosenberg 2008). Management of aquaculture in an ecological context is an emerging issue and guidance to mitigate habitat impacts is not complete. Therefore, aquaculture policy and regulatory recommendations are not included in this document.

2.4.3 Forest Practices. Forest practices can impact salmonid habitat functions when forest activities, such as road building, impede fish passage and extensive clearing associated with timber harvest removes vegetation and compacts soil. This influences water flows and can result in erosion and sedimentation, introducing fine particles into streams. Fine particles can clog spawning substrates, inhibiting the interchange of oxygenated water and cause egg suffocation and juvenile entombment (Everest et al. 1987; NRC 1996). The removal of downed woody debris also takes away natural damming debris from the forest floor (Knutson and Naef, 1997).

Photo 11: Logged Wetland

The removal of timber in upland areas can influence salmonid habitat even in areas with non-fish bearing streams. Removing vegetation exposes upland riparian areas to direct sunlight thereby increasing water temperatures (Chamberlin et al. 1991). Water is warmed when flowing over the surface of warmer land and unbuffered tributaries and eventually reaches fish-bearing streams at lower elevations.

The Forest and Fish Law (Chapter 76.09 RCW) was created to address habitat impacts associated with commercial timber harvest, however, non-commercial timber removal and conversion of forest lands to developed lands are regulated by local governments. Land use planning for salmon, steelhead and trout should include protection and management of terrestrial and aquatic areas to avoid forest practices related activities (such as road building) and land conversions.

2.4.4 Habitat Impacts Associated with Land Use. Table 2.1 includes a list of potential development actions related to urban and rural growth (R2 Resource Consultants et al. 2000), the habitat function potentially impacted (May et al. 1996) and the potential planning tool that if implemented, would promote the protection of existing salmonid habitat functions. Chapter Three contains further discussion of planning tools to maintain habitat functions. A reference to indicate corresponding management recommendations is indicated using parentheses in column three (e.g., 3.2.1, etc.)

Table 2.1: Planning tools to manage development impacts on salmonid habitat

Development Action	Potential Impact on Salmonid Habitat Function	Potential Planning Tool to Manage Development Impacts
River channel clearing and channelization (stream bank alterations)	Water quality, flow regime, habitat structure, access	Channel Migration Zone protection (3.2.9), riparian buffers and vegetation retention (3.2.3),[9] floodplain protection (3.2.8), large woody debris recruitment (3.2.6), in-stream work standards (3.2.7), clearing and grading standards (3.3.4)
Loss of riparian vegetation	Water quality, flow regime, habitat structure, food source	Riparian buffers and vegetation retention (3.2.3), building setbacks (3.3.5), stormwater management (3.2.2), LID practices (3.2.2), clearing and grading standards (3.3.4), LWD recruitment standards (3.2.6), habitat restoration projects (3.2.1), incentives to protect habitat (3.3.10)
Loss of forested areas	Water quality, flow regime, access, habitat structure	Forest land conversion regulations (3.3.8), riparian buffers and riparian vegetation retention on all streams (3.2.3), LWD recruitment standards (3.2.6), incentives to protect habitat (3.3.10), zoning regulations (3.3.2)
Loss of farmland	Flow regime, access, habitat structure	Zoning regulations (3.3.2), incentive programs to retain working farmland that follow best management practices (e.g., purchase or transfer of development rights, voluntary restoration programs) (3.3.7; 3.3.10).

[9] Restoration projects that provide a net benefit to habitat functions are allowed in buffers. Buffers are intended to prohibit development and vegetation clearing in the riparian buffer.

Table 2.1: Planning tools continued

Development Action	Potential Impact on Salmonid Habitat Function	Potential Planning Tool to Manage Development Impacts
Loss of wetlands	Water quality, flow regime, habitat structure, food source	Wetland buffers and development standards (e.g., no-fill) (3.2.5), building setbacks (3.3.5), clearing and grading standards (3.3.4), incentives to protect habitat (3.3.10).
Loss of estuarine and nearshore areas	Water quality, habitat structure, food source, access	Shoreline development standards/ riparian buffers and vegetation retention (3.2.3; 3.2.4), building setbacks (3.3.5), floodplain protection (3.2.8), incentives to protect habitat (3.3.10).
Bulkhead and overwater structures	Water quality, flow regime, habitat structure, food source	Shoreline development standards/ riparian buffers and vegetation retention (3.2.3; 3.2.4), building setbacks (3.3.5), floodplain protection (3.2.8).
Upland clearing and grading	Water quality, flow regime, habitat structure, food source, access	Zoning regulations (3.3.2), Channel Migration Zone protection (3.2.9), Landslide Hazard Area protection (3.2.10), riparian buffers and vegetation retention (3.2.3), floodplain protection (3.2.8), clearing and grading standards (3.3.4).
Fish passage barriers	Flow regime, habitat structure, access	Road standards (3.3.6), non-commercial forest practices (3.3.8).
Water allocations/ stormwater runoff	Water quality, flow regime	Stormwater management (3.2.2), LID practices (3.2.2), water quality standards (3.2.11).
Industrial effluent	Water quality	Zoning regulations (3.3.2), water quality standards (3.2.11).

CHAPTER THREE
PLANNING FOR SALMON, STEELHEAD AND TROUT

3.1 SMA/GMA and Salmonid Recovery

With approximately fifty-four percent of uplands in Washington State in private ownership (IAC 2001) and mostly under the planning authority of local governments, the land use decisions of landowners and local governments influence salmonid survival to a great extent. Two laws that are most influential to governing salmonid habitat at the local level are the Shoreline Management Act (SMA) and Growth Management Act (GMA). Under both of these statutes, local governments are required to develop planning policies and regulations that protect anadromous fish resources.

3.1.1 Shoreline Management Act. The Shoreline Management Act (Chapter 90.58 RCW), or SMA, requires all local governments in Washington State to adopt Shoreline Master Programs (SMPs) that contain policies and regulations that will ensure no net loss of shoreline ecological functions. The SMA establishes a balance of authority between local and state government. Cities and counties are the primary regulators, but the state (through the State of Washington Department of Ecology) has approval authority of local master programs and some permit decisions (variances and conditional use permits). Shoreline areas affected include marine waters, streams with a mean annual flow greater than 20 cubic feet per second, water areas of the state greater than 20 acres, land extending 200 feet landward of the ordinary high water mark and associated wetlands, river deltas and some or all of the 100-year floodplain.

Protecting "the land and its vegetation and wildlife, and the waters of the state and their aquatic life" is a fundamental policy goal of the SMA. As stated in the Legislative findings of the Act:

> *RCW 90.58.020 (Excerpts) …It is the policy of the state to provide for the management of the shorelines of the state by planning for and fostering all reasonable and appropriate uses. …. This policy contemplates protecting against adverse effects to the public health, the land and its vegetation and wildlife, and the waters of the state and their aquatic life, while*

> *protecting generally public rights of navigation and corollary rights incidental thereto….*
>
> *In the implementation of this policy the public's opportunity to enjoy the physical and aesthetic qualities of natural shorelines of the state shall be preserved to the greatest extent feasible consistent with the overall best interest of the state and the people generally. To this end uses shall be preferred which are consistent with control of pollution and prevention of damage to the natural environment, or are unique to or dependent upon use of the state's shoreline. …*
>
> *Permitted uses in the shorelines of the state shall be designed and conducted in a manner to minimize, insofar as practical, any resultant damage to the ecology and environment of the shoreline area and any interference with the public's use of the water.*

SMPs are, at a minimum, to achieve no net loss of ecological functions necessary to sustain shoreline natural resources and to plan for restoration of ecological functions where they have been impaired (WAC 173-26-201(2)(c)). The SMP guidelines (WAC 173-26) point to ecosystem connections among freshwater, marine and terrestrial shoreline environments that support anadromous fish life cycles. Every SMP is based on local conditions and includes an inventory and characterization of shoreline areas, environment designations, shoreline goals, policies and regulations, a cumulative impacts analysis, and a shoreline restoration plan.

When preparing and amending an SMP, there are opportunities to give special consideration to protect salmonid habitat functions in several phases of the program. In the *Inventory and Characterization of Shoreline Areas,* each jurisdiction is required to prepare an analysis of relevant shoreline issues of concern including “fish and wildlife conservation areas”; anadromous fish habitat is a fish and wildlife conservation area of concern. *Environment Designations* are based on the existing pattern of use, the biological and physical character of the shoreline, and the goals and aspirations of the community as expressed through comprehensive plans as well as SMP criteria. The SMP Guidelines recommend six basic environment designations (WAC 173-26-211). Environment designations most appropriately assigned to critical salmonid habitat are “natural,” “conservancy,” “urban-conservancy,” and “aquatic”.

Data from the shoreline inventory, which ideally incorporates information from local salmon recovery plans, nearshore and watershed analyses, and priority habitats and species data, can help determine where these areas are located. Examples of such areas might include spawning beds (e.g., forage fish spawning beaches, intact kelp and eelgrass beds) and areas of high quality, intact native vegetation identified in a habitat assessment or recovery plan as key to supporting listed populations. Because environment designations inform development regulations, assigning appropriate environment designations to these habitat areas can help protect the remaining highest quality salmonid habitat areas.

SMP documents also include a *Restoration Plan* to achieve overall improvements in shoreline ecological functions over time. Restoration plans influence salmonid recovery because each considers and addresses existing restoration projects, identifies degraded areas, prioritizes future restoration projects and provides monitoring strategies to ensure restoration projects and programs will be implemented consistent with the plan. SMP Restoration Plans should be closely linked with existing salmonid recovery efforts, including habitat limiting factors analysis, salmon recovery plans, lead entity strategies and associated multi-year work plans and watershed management plans.[10] More information on coordination with salmonid recovery programs is provided in Appendix A.

Finally, SMPs are to establish *Shoreline Policies and Regulations* that apply to shoreline modifications and uses. Shoreline rules are to be at least as protective as the jurisdictions critical areas ordinance (discussed further in the GMA section) and assure that development does not result in a net loss of ecological functions[11]. Because shoreline regulations are to be based on scientific and

[10] The Watershed Planning Act was enacted by the Washington State Legislature in 1998. The act encourages local governments to develop watershed plans using collaborative processes. The plans are based on water resource inventory areas (WRIAs). The Department of Ecology provides funding for and reviews watershed management plans. Watershed management plans address four main items, water availability, water quality, fish habitat, and in-stream flows. These plans include specific recommended actions linked to land use planning and coordination with salmon recovery plans.

[11] The State of Washington Departments of Ecology and Commerce have published interim guidance on determining shoreline jurisdiction and integration with critical areas designated under GMA (*http://www.ecy.wa.gov/programs/sea/sma/st_guide/SMP/index.html*). WDFW encourages local governments to consider RCW 90.58.030, which allows land necessary for buffers for critical areas that

technical information[12] permitted development can be assessed at an ecosystem scale rather than site-specific scale. If implemented, this will result in better protection of salmonid habitat by considering ecosystem-wide processes in land use decisions.

The SMP establishes a framework for protecting critical shoreline areas in the State of Washington. To further protect salmonids, the environment designation informs policies and provisions for regulating development, the inventory and characterization can be referenced to assess cumulative impacts to ecological functions, and the restoration plan can be referenced to determine consistency with recovery priorities and inform habitat mitigation. For example, if local salmonid recovery goals are integrated into the goals of the restoration plan, then linking mitigation to opportunities identified in the restoration plan will not only mitigate site-specific project impacts, but move overall recovery forward. Port Townsend's restoration plan lists a number of groups (including the Hood Canal Coordinating Council) and programs as resources for achieving restoration goals. The plan states:

> *"…the City's SMP represents an important vehicle for facilitating and encouraging restoration projects and programs that could be led by private and/or non-profit entities…*
>
> *When shoreline development occurs, the City should look for opportunities to conduct restoration in addition to minimum mitigation requirements. Development may present timing opportunities for restoration that would not otherwise occur and may not be available in the future." Section 14.9, Port Townsend SMP.*

3.1.2 Growth Management Act. In 1990 the Legislature found that "uncoordinated and unplanned growth, together with a lack of common goals… pose a threat to the environment, sustainable economic development, and the

occur within shorelines of the state to be included in the SMP. Including these buffers will help to ensure consistent regulation of activities across the critical area.

[12] The scientific standards for SMPs, which is "the most current, accurate and complete scientific or technical information available" [excerpt from WAC 173-26-201(2a)], differs somewhat from the Best Available Science rule RCW 36.70A.172 for critical areas ordinances. However, the same sources of scientific and technical information are useful to both SMP and CAO provisions regarding anadromous fish.

health, safety, and high quality of life enjoyed by residents of this state. It is in the public interest that citizens, communities, local governments, and the private sector cooperate and coordinate with one another in comprehensive land use planning." This is the foundation for the Washington State Growth Management Act (Chapter 36.70A RCW), or GMA.

Several planning goals (RCW 36.70A.020) adopted in the Act influence salmonid recovery and protection:

> *Goal 8: Natural resource industries. Maintain and enhance natural resource-based industries, including productive timber, agricultural, and fisheries industries. Encourage the conservation of productive forest lands and productive agricultural lands, and discourage incompatible uses.*
>
> *Goal 9: Open space and recreation. Retain open space, enhance recreational opportunities, conserve fish and wildlife habitat, increase access to natural resource lands and water, and develop parks and recreational facilities.*
>
> *Goal 10: Environment. Protect the environment and enhance the state's high quality of life, including air and water quality, and the availability of water.*

Local governments must consider these goals in relation to other important GMA goals for providing efficient transportation, economic development, housing, and respecting property rights, among others. This document focuses on opportunities to implement GMA goals and requirements related to salmonid protection and recovery. However, recommendations are provided with understanding about the sometimes competing priorities local governments face when implementing GMA requirements. Within this challenging framework, most counties and cities in Washington are required to implement specific aspects of the GMA. They must agree on county-wide planning policies to guide regional issues such as urban growth areas, public facilities, economic development, and affordable housing. They must adopt comprehensive plans to provide the framework and policy direction for land use decisions made within the local jurisdiction. Finally, they must adopt development regulations that carry out their comprehensive plans.

Although not all jurisdictions must plan fully under GMA, all jurisdictions are required to designate and protect natural resource lands and critical areas. Critical areas include the following areas and ecosystems: (a) wetlands; (b) areas with a critical recharging effect on aquifers used for potable water; (c) fish and wildlife habitat conservation areas (including rivers, streams, lakes, and salt water shorelines); (d) frequently flooded areas; and (e) geologically hazardous areas (RCW 36.70A.030(5)). These areas are to be designated and protected using the best available science to protect the functions and values of environmentally sensitive areas (RCW 36.70A.172).

> *(1) In designating and protecting critical areas under this chapter, counties and cities shall include the best available science in developing policies and development regulations to protect the functions and values of critical areas. In addition, counties and cities shall give special consideration to conservation or protection measures necessary to preserve or enhance anadromous fisheries. RCW 36.70A.172(1).*

In addition to developing policies and regulations based on best available science, the Act goes further and requires that "special consideration" be given to conservation or protection measures necessary to preserve or enhance anadromous fisheries (WAC 365-195-900). Special consideration means that measures supported by current science relating to protection or enhancement for anadromous fish resources should be given more weight[13]. If protective measures are identified as necessary for the protection or enhancement of anadromous fish resources they should be carefully evaluated; those that are applicable to local conditions should be used.

Special consideration of anadromous salmonid habitat includes designating and protecting the aquatic and terrestrial environments that influence salmonid habitat functions, including water quality, flow regime, food source, access, and habitat structure. In order to be effective for salmonid habitat protection, critical area regulations should address the condition and extent of water-related resources as well as upland processes that affect aquatic habitat including

[13] The description of "special consideration" is consistent with how this term is defined in WAC 365-195-925. Growth Management Hearings Board findings support that "special consideration" requires science to be more heavily weighted than might otherwise be required by BAS provisions. See *Diehl v. Mason County* 95-2-0073 (Compliance Order, 3-22-00); *FOSC v. Skagit County* 96-2-0025c (Compliance Order, 8-9-00), and *FOSC v. Skagit County* 00-2-0033c (Final Decision and Order, 8-9-00).

watershed processes of canopy cover, extent of impervious surface, stormwater, water quality, water allocations, watershed hydrology, nutrient flow, and species interactions.

3.2 Recommendations for Protecting Salmonid Habitat in Local Planning

This section highlights policy and regulatory considerations for local governments to protect salmonid habitat functions in freshwater, marine and terrestrial environments. Policies are included because these establish the vision for protecting anadromous fish resources. Regulations have been included because rules, along with volunteer efforts and incentive programs discussed in section 3.3.10, are necessary to implement the vision.

Recommendations are organized by topic areas that include specialized management programs (e.g., stormwater) or habitat elements (e.g., nearshore areas) to protect salmonid habitat function from development impacts. Within each topic area, example policy and regulatory language is provided, as well as planning resources for additional guidance. For example, a riparian area is a habitat element and retaining a vegetated riparian buffer is a recommendation that would increase shade and reduce stream temperature, reduce impervious surface, filter sediments and other pollutants, contribute to terrestrial food sources, and recruit large woody debris. Prohibiting development in riparian buffers therefore maintains salmonid habitat functions such as water quality, food source, habitat structure and flow regime. Planning resources, such as riparian and nearshore management recommendations, are listed for more in-depth scientific recommendations to determine riparian buffer widths.

Throughout all of the regulatory programs and management approaches described below, mitigation sequencing is important to ensure no net loss of critical salmonid habitat functions. The sequencing for mitigation is straightforward: first try to avoid the impact altogether, then move to minimizing, reducing, and compensating for the impact. While detailed mitigation recommendations to repair, rehabilitate or restore specific habitat impacts are beyond the scope of this document, a few mitigation-related recommendations have been included throughout the tables. The salmon recovery plans, planning resources listed in the tables, literature cited and general references provide data and more specific recommendations for moving through the mitigation

sequence. Mitigation plans should be developed and implemented by qualified professionals. In all mitigation, monitoring is essential.

To protect anadromous fish habitat, special emphasis should be placed on management of the following categories listed below. These categories represent the key management program or salmonid habitat element related to land use changes that local planning can address.

1. Integration of Salmon Recovery Plans
2. Stormwater Runoff
3. Riparian Areas
4. Nearshore Areas
5. Wetlands
6. Large Woody Debris Recruitment
7. In-Stream Habitat
8. Floodplain Areas
9. Channel Migration Zone
10. Landslide Hazard Areas
11. Water Quality

A note on climate change: Climate variability and change is an emerging issue and many of the policy and regulatory consideration in the proceeding tables tailored to salmonid habitat would also address planning for climate change. Some examples of predicted climate change impacts in Washington state related to salmonid habitat include: shifts in seasonal streamflow timing; rising stream temperatures that will likely reduce the quality and extent of freshwater salmon habitat; exacerbated flooding due to predicted high levels of precipitation in the Puget Sound, decreased reservoir storage in central Washington; and sea level rise shifting coastal beaches inland and increasing erosion of unstable bluffs (Mote et al. 2008). For more information on the predicted impacts of climate change in Washington state visit the University of Washington Climate Impacts Group: *http://cses.washington.edu/cig/fpt/planning.shtml*; State of Washington Department of Ecology: *http://www.ecy.wa.gov/climatechange/index.htm*; and Puget Sound Partnership: *http://www.psparchives.com/our_work/climate.htm*.

3.2.1 Integration of Salmon Recovery Plans. There are watershed planning processes and salmonid recovery activities (e.g., site specific restoration projects) underway throughout the state, often more than one in the same watershed. In order for salmonid recovery to succeed, it is critical that salmon protection, recovery and enhancement efforts be tracked and coordinated amongst the various partners (e.g., government agencies, non-profit and tribes).

Photo 12: Riparian Vegetation Restoration

Internal agency coordination is also critical. Local government staff involved in salmon recovery planning may not be the same staff as those developing and implementing land use policies and regulations. Therefore, coordination amongst departments is imperative. Coordination includes partnership and collaboration with outside agencies and groups as well as agencies within the local government. Depending on how a local government is organized, administrative services, health departments, parks, planning, building and public works departments may all influence land use decisions that affect salmonid habitat.

Table 3.2.1: Integration of Salmonid Recovery Plans Recommendations

Policy Considerations	• Continue to work with other local, State, federal, and tribal agencies to jointly develop and implement comprehensive integrated watershed and salmon recovery plans (including associated multi-year work plans). • Coordinate planning programs with regional salmonid recovery organizations to ensure development standards are consistent with salmonid protection and restoration. • Adopt regional and watershed salmon recovery plans by reference and consider these as sources of best available science. • Develop and adopt salmonid recovery plans including an inventory of watersheds and local restoration and protection priorities based on best available science (see City of Seattle example listed below). • Coordinate Shoreline Master Program restoration plans with salmonid recovery and watershed management plans, water clean-up plans for TMDLs, stormwater management programs, and with stormwater basin plans where they have been developed. For example, implement a process to align projects in salmon recovery plans with areas identified in the SMP as needing restoration. • Adopt a resolution that directs all county departments to establish salmonid recovery priorities and programs consistent with lead entity strategies and regional salmon recovery plans.
Policy Example (Prioritizing Salmon Recovery and Protection): *In December 2003, the city of Seattle finalized the Urban Blueprint for Habitat Protection and Restoration. The Urban Blueprint analyzes what chinook salmon do as they move through Seattle, and helps identify the actions needed to protect them. The Urban Blueprint draws on recent and groundbreaking research by independent scientists and guides the city in making wise investments in salmon recovery. http://www.seattle.gov/util/About_SPU/Management/SPU_&_the_Environment/SalmonFriendlySeattle/SPU01_002751.asp.* ***Policy Example (Salmon Recovery Planning):*** *King County shall continue to participate in the Water Resource Inventory Area based salmonid recovery plan implementation efforts and in other regional efforts to recover salmon and the ecosystems they depend on, such as the Puget Sound Partnership. King County's participation in planning and implementation efforts shall be guided by the following principles: a. Focus on early federally listed salmonid species first, take an ecosystem approach to habitat management and seek to address management needs for other species over time; b. Concurrently work on early actions, long-term projects and programs that will lead to improvements to, and information on, habitat conditions in King County that can enable the recovery of endangered or threatened salmonids, while maintaining the economic vitality and strength of the region; c. Address both King County's growth management needs and habitat conservation needs; d. Use best available science as defined in WAC 365-195-905 through*	

Table 3.2.1: Integration of Salmonid Recovery Plans Recommendations

<table>
<tr><td colspan="2">365-195-925; e. Improve water quality, water quantity and channel characteristics; f. Coordinate with key decision-makers and stakeholders; and g. Develop, implement and evaluate actions within a watershed-based program of data collection and analysis that documents the level of effectiveness of specific actions and provides information for adaptation of salmon conservation and recovery strategies. King County Comprehensive Plan Chapter Four, Environment, Policy 601.

Policy Example (Internal Consistency): Planning and design of flood control works and instream structures should be consistent with and incorporate elements from applicable watershed management plans, restoration plans and/or surface water management plans. Whatcom County Shoreline Master Program, Flood Control Works and Instream Structures, 23.100.06.</td></tr>
<tr><td>Regulatory Considerations</td><td>• Match allowed uses requiring mitigation to appropriate restoration and enhancement activities as identified in salmonid recovery, watershed management, and shoreline restoration plans.
• Ensure shoreline environment designations and associated uses are consistent with areas identified as protection or restoration priorities in salmonid recovery, watershed management, and shoreline restoration plans.
• Conduct “planned actions” through decision-making that integrates the work of planning, stormwater management, parks, and other local departments.</td></tr>
<tr><td colspan="2">Regulatory Example (Habitat Area Enhancement/Restoration): The approval authority may, in consultation with WDFW and other experts (such as tribal biologists or DNR botanists), approve restoration of important habitat areas and associated buffers subject to an approved critical area report and restoration plan (see Section 17.15.880) and applicable provisions of this chapter. Stream enhancement/restoration shall only be performed under a plan for the design, implementation, maintenance and monitoring of the project approved by a qualified fisheries biologist and, if needed, by a civil engineer with experience in stream hydrology. The project shall be carried out under the direct supervision of a qualified fisheries biologist, hydrologist, or engineer with demonstrated experience, as appropriate. Thurston County Critical Areas Ordinance (In Draft), 17.15.860, http://www.co.thurston.wa.us/permitting/.</td></tr>
<tr><td>Planning Resources</td><td>See Chapter One for links to regional recovery plans and Appendix A for a list of salmonid recovery planning resources including watershed management plans, habitat limiting factors reports and mapping resources.</td></tr>
</table>

3.2.2 Stormwater Runoff. Traditional urban and rural development practices remove forests, vegetation and topsoil, compact soils, and increase impervious surface areas, diminishing the land's ability to hold and infiltrate rainwater. The remaining water becomes stormwater runoff, rushing off impervious surfaces such as roofs, roads and compacted soils instead of infiltrating the soil column (Booth 2000). Stormwater runoff can alter substrate conditions by carrying fine sediment to streams, which may reduce spawning gravel quality for salmonids and harm their food sources such as aquatic invertebrates.

In addition, changes in the frequency, magnitude, and timing of stormwater runoff results in stream channel and ecosystem alterations that are detrimental to salmon and their habitat (May 2009). Increased peak flows cause channel widening and shallowing, exposing streams to greater solar insolation and contributing to stream temperature warming. Runoff and erosion can also lead to channel incision, increasing stream velocity, and causing more frequent and deeper flood scour of the stream bed and salmon redds. Flashier stormwater runoff timing decreases groundwater recharge and reduces surface water-groundwater interactions, which cools stream water for cold-water dependent salmonids. In the Puget Sound, stormwater outfalls concentrate runoff onto discrete locations on the beach, inhibiting the flow of water that might normally exist over broader reaches of beach. This may impact habitats and species particularly sensitive to desiccation, including forage fish eggs.

Habitat functions impacted by stormwater runoff include water quality, flow regime, habitat structure and food source.

Stormwater runoff from impervious surfaces also transports contaminants, especially metals, petroleum hydrocarbons, pesticides, and herbicides, to surface waters where suspected synergistic effects may be detrimental to salmonids (Scholz et al. 2000). Thus, ecosystem changes resulting from altered stormwater runoff regimes directly and indirectly jeopardize a number of different habitat elements on which salmonids rely.

Runoff is of particular concern in regions of intense rainfall, such as glacial outwash regions surrounding Puget Sound, or limited vegetation and landscapes with thin soils, such as the arid and semiarid interior east of the Cascade Range (Booth 2000). Recent research in western Washington has determined that measurable degradation to downstream aquatic habitat occurs where impervious

cover exceeds 5-10% and native forest cover is reduced to less than 65% of watershed area (May et al. 1996; Booth 2000). Washington state agencies such as the Puget Sound Partnership and the State of Washington Department of Ecology, as well as the federal Environmental Protection Agency, have determined that stormwater runoff is the leading contributor to water quality pollution of urban waterways in western Washington State (*http://www.psp.wa.gov/stormwater.php*). Therefore, it is imperative that local governments manage stormwater with policies, regulations and incentive programs (e.g., LID) to reduce and treat stormwater runoff.

Table 3.2.2: Stormwater Runoff Management Recommendations[14]

Policy Considerations	• Adopt a stormwater design manual equivalent to the State of Washington Department of Ecology's most current version of "Stormwater Management Manual for Western Washington" or "Stormwater Management Manual for Eastern Washington." The minimum requirements of these Ecology manuals for new and redevelopment should be used, including the flow control and treatment standards. • Use the Low Impact Development (LID) approach and techniques to better manage stormwater for new development, redevelopment and retrofit projects. This includes: limit land clearing, retain and, where necessary, restore native vegetation and soils, minimize site disturbance and development footprints, limit impervious surfaces through use of permeable pavement or other techniques, create graded swales and rain gardens to disperse and infiltrate stormwater runoff on site, and utilize rainwater catchment for landscaping irrigation. • Implement a comprehensive stormwater management program to manage runoff from existing development, including: prohibiting, finding and remedying pollution discharges, properly maintaining stormwater systems, conducting public education, implementing source control and retrofits for existing stormwater facilities, and guiding stormwater basin planning. (NPDES Phase I and Phase II Municipal Stormwater Permit Program – State of Washington Department of Ecology: *http://www.ecy.wa.gov/programs/wq/stormwater/municipal/index.html*).
***Policy Example (Management Methods**): Stormwater runoff shall be managed through a variety of methods, with the goal of limiting impacts to aquatic resources, reducing the risk of flooding, protecting and enhancing the viability of agricultural lands and promoting groundwater recharge. Methods of stormwater management shall include temporary erosion and sediment control, flow control facilities, water quality facilities as required by the Surface Water Design Manual, and best management practices as described in the Stormwater Pollution Control Manual. Runoff caused by development shall be managed to prevent adverse impacts to water resources, forests, and farmable lands. Regulations shall be developed for lands outside of the Urban Areas that favor nonstructural stormwater control measures when feasible including: vegetation retention and management; clearing limits; limits on actual and effective impervious surface; low-impact development methods that minimize direct overland runoff to receiving streams; and limits on soil disturbance. King County Comprehensive Plan Chapter Four, Environment, Policy 419.*	

[14] See also Table 3.2.11 Water Quality Management Recommendations.

Table 3.2.2: Stormwater Runoff Management Recommendations[14]

Regulatory Considerations	• Incorporate adaptive management provisions to address cumulative increases to total impervious area and reductions in forest cover to thresholds at the sub-basin scale in stormwater regulations. Thresholds are based on best available science. To protect aquatic resources, WDFW recommends limiting impervious surfaces to no more than 10% of an urban watershed. More than 10% impervious surfaces will have responding effects on channel morphology, water quality, and fish and wildlife habitat functions regardless of the width of the riparian area (Knutson and Naef 1997). • Encourage limited impervious surfaces, vegetation retention, and retention of natural soils and topography in site design by incorporating Low Impact Development standards. • Prohibit new discharge facilities from contributing pollutants and excessive artificial nutrients to riparian areas. • Require temporary or permanent erosion and sedimentation controls to prevent the introduction of sediments or pollutants to water bodies or water courses within salmonid habitat.
Regulatory Example (Management Manual): *The proposed activity must be designed and constructed in accordance with the Stormwater Management Manual for Eastern Washington, as amended (Ecology 2004) for those geographic areas covered under the Eastern Washington Phase II Municipal Stormwater Permit (Ecology 2007) or activities covered under the Ecology General Construction Permit (Ecology 2005), and/or the locally adopted program, as applicable. Walla Walla County Critical Areas Ordinance, 18.08.240.*	
Planning Resources	**Stormwater Management and Design Manual:** State of Washington Department of Ecology, *http://www.ecy.wa.gov/programs/wq/stormwater/index.html*. **Low Impact Development Technical Guidance Manual for Puget Sound:** Puget Sound Action Team (Hinman 2005), *http://www.psparchives.com/publications/our_work/stormwater/lid/LID_manual2005.pdf*. **Stormwater Resources:** Puget Sound Partnership, *http://www.psparchives.com/our_work/stormwater/stormwater_resources.htm*. **Watershed Processes and Aquatic Resources: A Literature Review:** Washington Department of Fish and Wildlife (May 2009), *http://wdfw.wa.gov/hab/watershed_aquaticreview.htm*. **Soil BMP Requirements:** *http://buildingsoil.org/ or http://www.soilsforsalmon.org/*.

3.2.3 Riparian Areas. Salmonids are particularly sensitive to their freshwater environments which includes aquatic environments such as off-channel wetlands and floodplain areas and adjacent terrestrial habitat which is the riparian area (or zone). Riparian areas influence multiple habitat functions: food source, habitat cover, habitat structure, oxygen, water quality, spawning grounds, migration routes to ocean systems and filters water runoff and substrate inputs to the riparian area (Kauffman et al. 2001; NMFS 2008). Protecting the riparian area to maintain these functions is essential to survival of salmonids and many other species.[15]

Photo 13: Fish Passage Barrier

Functional riparian areas have adequate vegetation that moderates the movement of materials between the terrestrial environment and the stream, provides shade which can have a significant effect on moderating water temperature and climate within riparian zones, provides streambank stabilization with erosion resistant roots that bind soils and builds banks during high flows, provides large woody debris, filters fine sediment from upstream urban development, and favors percolation into groundwater, where soil filters many contaminants, keeping them out of water bodies (Knutson and Naef 1997; Cederholm 2000; Kauffman et al. 2001). Riparian vegetation also provides a home for terrestrial insects and aquatic insects which feed upon organic matter (litterfall) derived from adjacent riparian vegetation that fall into the stream (Kauffman et al. 2001). This underscores the importance of maintaining healthy, diverse, and mature riparian vegetation to provide a steady food source to the stream as well as nearshore ecosystems (discussed in section 3.2.4). The functions of riparian areas are fundamentally altered when upland and riparian vegetation is removed (May 2003).

Maintaining connectivity of small freshwater tributaries to larger riparian systems is also an important consideration. Salmonids migrate or use different areas of a watershed at different times during their life histories. Artificial barriers to migration disrupt connectivity. Fish passage barriers include poorly designed

[15] Knutson and Naef (1997) estimate 85% of Washington's terrestrial vertebrate species use riparian habitat for essential life activities.

culverts and dams as well as areas made too shallow for fish to swim past because of water diversion or groundwater pumping.

Small streams, both non-fish bearing and fish bearing, are important for determining the amounts and timing of stream flow and therefore salmonid habitat downstream. In mountain streams, much of the flow, as well as the timing and quality of flow, is determined by headwater processes (snowfall, freezing, melt, glacial melt, rainfall). Disturbance (such as timber cutting and road building) will impact the hydrologic flow regime and water quality. Small freshwater tributaries at any elevation that are tightlined or filled as part of land development also diminish the function of hydrologic regimes, reducing infiltration, as well as nutrient and substrate contribution to marine waters or larger river systems (Cederholm et al. 2000). The reduction of terrestrial vegetation can elevate maximum stream temperatures, increase flow fluctuations and reduce winter stream temperatures (where ice formation is a concern, like some eastern Washington streams) (R2 Resource Consultants et al. 2000). Small fish-bearing tributaries also provide important refuge areas for juvenile salmonids trying to survive winter floods.

Freshwater aquatic environments are not only influenced by terrestrial vegetation alterations, but also in-water projects. Hydraulic projects such as shoreline armoring and overwater structures can impact salmonid habitat functions in lakes and streams by decreasing aquatic food supply, changing prey diversity, disrupting migration and feeding areas, increasing wave energy, increasing scour, and increasing predation. Shoreline armoring can also eliminate a potential source of sediment/spawning gravel inputs associated with natural channel migration and erosional processes and may reduce future spawning gravel recruitment in downstream stream reaches.

Habitat functions maintained by riparian areas include water quality, flow regime, habitat structure, food source and access.

Wide terrestrial buffers, a near-continuous corridor, mature, native vegetation, and limits on in-water projects are all necessary to protect salmonid habitat functions in riparian areas. Riparian buffers should be established based on best available science for the resource, the quality of existing riparian vegetation and the ability of the site to grow mature native trees (May et al. 1996). In areas with existing development (where natural buffers are unrealistic), explicit provisions for

retaining and/or replanting (and maintaining, particularly during plant establishment) native vegetation for a variety of land uses can be required and enforced to compensate for inadequate existing buffers and flexible development standards.

Table 3.2.3: Riparian Areas Management Recommendations[16]

Policy Considerations	• Protect and restore natural streambank, estuarine and nearshore conditions and functions, including vegetative cover, natural input of large woody debris and gravels by adopting riparian buffers (and associated building setbacks) and avoiding bank hardening. • Designate natural buffers of a width based on best available science along all riparian systems that support salmonid habitat. Riparian systems include fish-bearing streams, feeder tributaries, wetlands, lakes as well as estuarine and nearshore areas. • Designate riparian buffers that maintain native riparian vegetation and encourage the restoration of riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting. • Use the *Washington State Integrated Streambank Protection Guidelines* and the *Washington State Stream Habitat Restoration Guidelines* when considering protection and restoration of stream habitat. • Restrict livestock access to streams and rivers to prevent streambank and vegetation degradation, channel widening and heating, and direct salmonid impacts, such as redd (nest) trampling.
Policy Example (Riparian Buffers): *Maintain buffers between land-disturbing activities and surface water resources to meet the standards of the best available fisheries science for protecting water resources and related habitat functions. Jefferson County Comprehensive Plan Chapter Eight, Environment Element, Policy 2.5.* ***Policy Example (Vegetated Buffers):*** *Vegetation removal adjacent to riparian areas, resulting from development or other activities, should be strictly controlled with adequate buffers maintained to support the healthy functioning of the hyporheic zone. Pierce County Comprehensive Plan, Water quality 19A.60.050.*	
Regulatory Considerations	• Adopt a setback of at least 15 feet from the edge of riparian buffers to protect buffer habitat from impacts associated with construction and buildings. • Establish natural vegetation buffer widths based on best available science and sufficient to maintain functions and processes necessary for salmonids. • If modifications or buffer averaging must be allowed to prevent an unreasonable hardship on a landowner,

[16] See also Table 3.2.4 Nearshore Areas Management Recommendations.

Table 3.2.3: Riparian Areas Management Recommendations[16]

	require habitat enhancement to protect the integrity, functions, and values of existing anadromous fish habitat (see below for habitat management plan recommendations). Buffer averaging requires review by a qualified habitat biologist. • Measure buffers landward from the Ordinary High Water Mark (OHWM). • Extend buffers to include adjacent critical areas buffers (such as those associated with wetlands, lakes, floodplains, and channel migration zones). • Require a habitat management plan, prepared by a qualified professional, for vegetation clearing in a buffer. Clearing of native vegetation is only permitted if no net loss to fish and wildlife habitat conservation areas can be shown or clearing of native vegetation is necessary to mitigate hazardous trees. Consideration should also be given to assessing the temporal loss of function(s) from such clearing. Although functions recover over time, interim measures to enhance recovery times and trajectories should be implemented. Preferably, some measures (e.g., replacement plantings) should be conducted prior to or concurrent with clearing activities to minimize overall temporal losses. A qualified professional must prepare the report (e.g., arborist). • Require a vegetation conservation plan to ensure native vegetation retention and restoration to ensure no net loss of marine and freshwater riparian functions. The plan is reviewed by a qualified professional. • Avoid permitting development that will require bank protection. If bank protection cannot be avoided, follow bank protection recommendations in the *Washington State Integrated Streambank Protection Guidelines*.
Regulatory Example (Vegetated Buffers): *Establishment of Buffers. The Director shall require the establishment of buffer areas for activities adjacent to habitat conservation areas when needed to protect habitat conservation areas. Buffers shall consist of an undisturbed area of native vegetation or areas identified for restoration established to protect the integrity, functions, and values of the affected habitat. Required buffer widths shall reflect the sensitivity of the habitat and the type and intensity of human activity proposed to be conducted nearby and shall be consistent with the management recommendations issued by the Washington Department of Fish and Wildlife. Walla Walla County Critical Areas Protection, Chapter 18.08.640.* ***Regulatory Example (Hazardous Trees):*** *(1) In a critical area or critical area buffer, removal of hazardous, diseased or dead trees and vegetation by the landowner may be permitted when necessary to: (a) Control fire; or (b) Halt the spread of disease or damaging insects consistent with the State Forest Practices Act, RCW 76.09; or (c) Avoid a hazard such as landslides; or (d) Avoid a threat to existing structures or above-ground utility lines. (2) Before hazardous, diseased or dead trees and vegetation may be removed by the*	

Table 3.2.3: Riparian Areas Management Recommendations[16]

landowner pursuant to subsection (1): (a) Unless there is an emergency pursuant to SCC 14.24.070(1), the landowner shall obtain written approval from Planning and Development Services. This consent shall be processed promptly and may not be unreasonably withheld. If the Administrative Official fails to respond to a hazard tree removal request within 10 business days, the landowner's request shall be conclusively allowed; and (b) The removed tree or vegetation should be left within the critical areas or buffer unless the Administrative Official, or a qualified professional, warrants its removal to avoid spreading the disease or pests; and (c) Any removed tree or vegetation shall be replaced with an appropriate native species in appropriate size. Replacement shall be performed consistent with accepted restoration standard for critical areas within one (1) calendar year. (d) For 14.24.130 only, a qualified professional shall mean a certified arborist, certified forester or landscape architect. Skagit County Critical Areas Ordinance, 14.24.130 Hazard Tree Removal.

Regulatory Example (Vegetation Retention): *Standards for allowed uses and activities. Vegetation Removal. 1. Removal of native vegetation. Removal of native vegetation within priority habitat, marine riparian habitat areas, and riparian habitat areas along streams, within wetlands and buffers of both shall be prohibited except as provided for in this chapter.3. Noxious weeds and invasive plants. a. Removal of noxious weeds, as defined by Chapter 16-750 WAC, under the direction of the Thurston County Noxious Weed Control Agency, is permitted in important habitat areas consistent with a county approved integrated pest management plan, applicable county and state regulations, and Subsections W(3)(d) and (e) below. b. Removal of invasive plants is permitted subject to Subsections W(3) (c-e). c. Plant removal shall be performed such that it will not increase the likelihood of stream bank erosion, marine bluff erosion (see Section 17.15.600), significantly damage untargeted vegetation, or impair any habitat functions. These areas may be maintained to promote native vegetation; The method of removal shall be approved in writing by Thurston County Development Services Department, consistent with applicable county, state, and federal regulations. d. Hand tools shall be used for plant removal unless the approval authority determines that the scale of the project warrants use of small scale equipment (e.g., riding mowers or light mechanical cultivating equipment) or other method (i.e., application of herbicide with a state and federally approved formulation by a licensed applicator in accordance with the safe application practices on the label) and use of the equipment/method does not pose a significant risk to untargeted areas, habitat functions, or water quality. e. Erosion shall be effectively controlled and exposed areas shall be stabilized immediately following plant removal consistent with Chapter 15.05 TCC. If the area of exposed soil exceeds 100 square feet, it shall be planted with appropriate native plant species present in the area at a density that will provide complete ground cover at maturity, unless the approval authority determines that the area will revegetate naturally without jeopardizing water quality or the important habitat area. Thurston County Critical Areas Ordinance (In Draft), 17.15.870, http://www.co.thurston.wa.us/permitting/.*

Table 3.2.3: Riparian Areas Management Recommendations[16]

Planning Resources	**Riparian Management Recommendations:** Washington Department of Fish and Wildlife Priority Habitats and Species Management Recommendations (Knutson and Naef 1997), *http://wdfw.wa.gov/hab/phspage.htm*. **Integrated Streambank Protection Guidelines:** Washington State Aquatic Habitat Guidelines Program (2002), *http://wdfw.wa.gov/hab/ahg*. **Stream Habitat Restoration Guidelines:** Washington State Aquatic Habitat Guidelines Program (2004), *http://wdfw.wa.gov/hab/ahg*. **Restoring the Watershed, A Citizen's Guide to Riparian Restoration in Western Washington.** Washington Department of Fish and Wildlife, *http://wdfw.wa.gov/recovery.htm*. **Managing Vegetation on Coastal Slopes:** State of Washington Department of Ecology, *http://www.ecy.wa.gov/programs/sea/pubs/93-31/intro.html*. **Riparian Areas: Functions and Strategies for Management.** National Research Council (NRC 2002), *http://www.nap.edu/books/0309082951/html/*. **Shoreline Management Jurisdiction:** • River and stream shorelines, State of Washington Department of Ecology, *http://www.ecy.wa.gov/programs/sea/sma/st_guide/jurisdiction/rivers.html*. • Lake shorelines, State of Washington Department of Ecology, *http://www.ecy.wa.gov/programs/sea/sma/st_guide/jurisdiction/rivers.html*. • Lake shorelines, Wild Fish Conservancy, *http://www.washingtontrout.org/laketyping.shtml*. **Mapping Resources (listed in Appendix A):** • *SalmonScape* • *WDFW Priority Habitats and Species Data* • *PSNERP Change Analysis*

3.2.4 Nearshore: Marine and Estuarine Areas. On the westside of the state, local governments regulate both freshwater and nearshore areas. Nearshore areas include the saltwater subtidal zone (marine), intertidal zone (open shoreline, estuaries and bays) and terrestrial riparian zone (Buchanan et al. 2001). Riparian areas along the nearshore enhance habitat function of nearshore areas for juvenile salmonids during their migration through Puget Sound to the open ocean. Estuaries are a particularly important nearshore habitat as they provide distinctive environmental conditions (e.g., brackish water) necessary for the physiological transition of juveniles from freshwater to saltwater and for mature adults returning to freshwater streams. Puget Sound shorelines and bays also provide important salmonid habitat for juvenile feeding and migration (Brennan and Culverwell 2004). Marine shorelines and bays along Washington's coast also provide feeding, refuge and migratory transition habitat for salmonids.

Habitat functions maintained by nearshore areas include water quality, flow regime, habitat structure, food source and access.

Nearshore riparian areas are vulnerable to many of the same impacts as freshwater riparian areas including stormwater runoff, loss of riparian vegetation,shoreline armoring and overwater structures. Overwater structures, such as floats, can impact salmonid prey sources and refugia when shading and grounding occurs. Shoreline armoring can impact nearshore environmental processes and functions by blocking, delaying, or eliminating sediment delivery to beaches necessary for sustaining smelt and sand lance spawning habitat (Penttila 2007). Nearshore habitat that supports both salmonids and forage fish will become increasingly vulnerable to disturbance and loss as sea levels rise and beach habitats are squeezed between rising waters and shoreline armoring (Washington State Climate Advisory Team 2007).

Photo 14: Nearshore Feeder Bluff

The management recommendations for marine, estuary, and freshwater riparian areas are very similar. Marine and estuarine riparian areas support many of the same habitat functions as freshwater riparian areas (food, access, habitat

structure) and management recommendations, such as maintaining vegetated riparian buffers are essential (Brennan and Culverwell 2004). Therefore, management recommendations provided in table 3.2.3, riparian areas management recommendations are relevant in nearshore environments.

Table 3.2.4: Nearshore Areas Management Recommendations[17]

Policy Considerations	• Designate natural shoreline buffers of a width based on best available science to protect salmonid habitat processes and functions. (See table 3.2.3 riparian areas for more on buffers.) • Designate natural shoreline buffers that maintain native riparian vegetation and encourage the restoration of riparian vegetation. When removal cannot be avoided, require mitigation that addresses cumulative impacts and requires replanting. • Maintain the connectivity and nursery habitat at the mouths of tributaries, estuaries, and wetlands and other nearshore habitats through the establishment of habitat buffers. • Identify and protect potential and known forage fish (herring, smelt, and sand lance) spawning areas. • Allow new bank stabilization of shorelines only after an imminent threat to existing residential or business structures or critical public facilities has been demonstrated by a geotechnical or hydrologic analysis and reviewed by a qualified third party. Structure relocations and innovative, bioengineering alternatives to hard armoring should always be considered first. • Require proposed bulkhead rebuild projects to evaluate the effectiveness of alternative designs (e.g., structure relocations and soft-shore approaches) as opposed to in-kind replacement. • Identify feeder bluffs and protect them (and their functions) through appropriate shoreline designation and SMP regulations. • Identify intact beach systems (including sediment delivery, transport, and accretion areas) and protect them through appropriate shoreline designation and SMP regulations. • Locate new or enlarged piers, floating docks, mooring buoys, navigational aids and swimming floats away from (and not in) marine aquatic vegetation beds and are sufficiently restricted to protect salmonid rearing areas and migration corridors. • Encourage community use projects for piers, boat ramps, and access sites.

[17] See also Table 3.2.3 Riparian Areas Management Recommendations.

Table 3.2.4: Nearshore Areas Management Recommendations[17]

Policy Example (Nearshore Habitat Designation and Protection): *The county should identify and protect, consistent with best available science, important, sensitive marine habitats, such as juvenile salmon migration corridors, kelp and eelgrass beds, shellfish beds, and herring and smelt spawning areas. Thurston County Comprehensive Plan Chapter Nine, Environment, Policy C.3.2.*	
Regulatory Considerations	• Establish marine riparian habitat areas and management zones consistent with best available science (examples include Knutson and Naef 1997; Tri-County Assembly 2000; Envirovision et al. 2007) extending on a horizontal plane, landward from the ordinary high water mark. The marine riparian habitat area retains existing conditions, including native vegetation. When conditions are degraded, replanting of native vegetation may be a condition for upland development. Development permitted in the marine riparian management zone is restricted as necessary to minimize adverse impacts to existing native vegetation that have a beneficial impact on marine critical areas, such as forage fish-spawning beaches. Development in the marine riparian management area requires a vegetation conservation plan or habitat management plan with measures to promote and sustain native vegetation and facilitate dispersion and filtering of runoff. • Include provisions for overwater structures such as, no grounding of floats, use of inert materials that do not pose a risk to water or sediment quality, full compliance with *U.S. Army Corps of Engineer Regional General Permit Number 6*, timing restrictions to protect critical forage fish spawning and incubation time, no fill or armoring of the shoreline, grating/materials that allow sunlight to penetrate docks, piers, and floats, and loss of existing native vegetation requires mitigation. Overwater structures should be constructed of materials that will not adversely affect water quality or aquatic plants and animals in the long term. • Prohibit bulkheads and piping systems that result in water falling rather than flowing and dispersing onto the shore. • Prohibit shoreline structures (e.g., boat ramps, groins) that disrupt drift cell function (such as sediment and gravel transport). • Replace disturbed marine riparian vegetation with equivalent native species appropriate for the site. Mitigation provides 100 % replacement of lost vegetation, and provide for an equal amount of vegetative function.

Table 3.2.4: Nearshore Areas Management Recommendations[17]

Regulatory Example (Overwater structures): *Marinas or launch ramps shall not be permitted within the following marine shoreline habitats because of their scarcity, biological productivity and sensitivity unless no alternative location is feasible, the project would result in a net enhancement of shoreline ecological functions, and the proposal is otherwise consistent with this Program: (1) Marshes, estuaries and other wetlands; (2) Tidal pools on rock shores; (3) Kelp beds, eelgrass beds, spawning and holding areas for forage fish (such as herring, surf smelt and sandlance); Whatcom County Shoreline Master Program, Boating Facilities: Marinas and Launch Ramps, 23.100.04.* ***Regulatory Example (Shoreline Armoring):*** *All shoreline development shall be located and designed to avoid or minimize the need for shoreline stabilization measures and flood protection works, such as bulkheads, revetments, dikes, levees, dikes, or substantial site regrades. Where measures and works are demonstrated to be necessary, biostabilization techniques shall be the preferred design option unless demonstrated to be infeasible or where other alternatives will provide less impact to the shoreline environment. [sic] City of Sumner Shoreline Master Program, General Environmental Impact Regulations, 16.16.020 (E).* ***Regulatory Example (Nearshore Habitat Protection):*** *All shoreline development and activity shall be located, designed, constructed, operated, and managed to minimize interference with beneficial natural shoreline processes including those that contribute to properly functioning conditions for proposed, threatened and endangered species, such as water circulation, sand and gravel movement, erosion, and accretion. City of Sumner Shoreline Master Program, General Environmental Impact Regulations, 16.16.020 (F).*	
Planning Resources	**Protecting Nearshore Habitat and Functions in Puget Sound:** Washington State Aquatic Habitat Guidelines Program (Envirovision et al. 2007), *http://wdfw.wa.gov/hab/nearshore_guidelines/*. **Marine and Estuarine Shoreline Modification Issues and Overwater Structures:** Washington State Aquatic Habitat Guidelines Program White Papers, *http://wdfw.wa.gov/hab/ahg/ahgwhite.htm*. **The Importance of Estuarine Habitats to Anadromous Salmonids:** United States Fish and Wildlife Service (Aetkin 1998), *www.fws.gov/westwafwo/fisheries/Publications/FP005.pdf*. **Mapping Resources (listed in Appendix A):** • *Salmonscape* • *WDFW Priority Habitats and Species* • *DNR Shorezone Inventory* • *Ecology Coastal Zone Atlas* • *PSNERP Change Analysis*

Photo 15: Natural Wetland Habitat

3.2.5 Wetlands. Wetlands are areas in the landscape that are inundated or saturated by surface or ground water and support vegetation adapted to life in saturated soil conditions (McMillan 1997). Wetlands promote more movement of water into groundwater, settle erosion products (instead of transporting them to a stream), and contribute to less extreme hydrology (May 2003). Stream-adjacent wetland habitat contributes to salmonid survival by providing off-channel habitat, food source and moderating stream flows. Wetlands and associated vegetation provide essential off-channel habitat to sustain young salmonid growth and protect them from predators (Spence et al. 1996). Wetland habitat also hosts amphibious species and insects that are potential food sources for salmonids. Wetlands moderate stream flows by preserving adequate water recharge to streams during low flow periods and protect rearing salmonids from the effects of high flows.

Habitat functions maintained by wetland protection include water quality, flow regime, habitat structure, food source and access.

Table 3.2.5: Wetlands Management Recommendations

Policy Considerations	• Adhere to *State of Washington Department of Ecology guidance* when identifying, classifying, and protecting wetlands (e.g., "Washington State Wetland Identification and Delineation Manual," "Washington State Wetland Rating System for Western Washington," "Wetlands in Washington State, Volume 2: Guidance for Protecting and Managing Wetlands.") • Protect the connectivity of wetlands to streams and nearshore habitats through the establishment of habitat buffers.
Policy Example (Wetland Protection): *King County's overall goal for the protection of wetlands is no net loss of wetland functions and values within each drainage basin. Acquisition, enhancement, regulations, and incentive programs shall be used independently or in combination with one another to protect and enhance wetlands functions and values. Watershed management plans, including ((Water Resource Inventory Area)) WRIA plans, should be used to coordinate and inform priorities for acquisition, enhancement, regulations, and incentive programs within unincorporated King County to achieve the goal of no net loss of wetland functions and values within each drainage basin. King County Comprehensive Plan Chapter Four, Environment, Policy 446. [sic]*	
Regulatory Considerations	• Rate, designate and map wetlands according to the State of Washington Department of Ecology Wetland Rating System. Activities allowed in wetlands do not alter the structure or functions of the existing wetland. Development in or near wetlands requires a critical areas report prepared by a qualified wetland scientist. • Tailor wetland buffers to protect specific anadromous fish habitat and functions, as supported by best available science. • If modifications or buffer averaging must be allowed to prevent an unreasonable hardship on a landowner, require a habitat management plan, prepared by a qualified professional, to protect the integrity, functions, and values of existing anadromous fish habitat. Buffer averaging requires review by a qualified habitat biologist. • Extend buffers to include adjacent critical areas (such as riparian areas). • Allow no fill or disposal of dredge material on wetlands.
Regulatory Example (Wetland Classification): *(1) Classification. Wetlands shall be classified using the 2004 Washington State Department of Ecology's Wetland Rating System for Western Washington (Ecology Publication #04-06-025), or as amended. Wetland rating categories shall not be determined*	

Table 3.2.5: Wetlands Management Recommendations

based upon illegal modification to the land. Wetland delineations shall be determined by using the Washington State Wetlands Identification and Delineation Manual, March 1997, or as amended hereafter. Jefferson County Critical Areas Ordinance 18.22.300.

Regulatory Example (Wetland Buffer Widths):

(A) *Increased Buffer Widths. The approval authority shall require an increase in the buffer width specified in Table 9-1 when a wider buffer is necessary to protect wetland and buffer functions, specified in subsections D (1) and (2) below. Buffer widths expanded pursuant to this section shall not be decreased through other provisions of this chapter.*

"(2) Inadequate vegetative cover to maintain water quality. If the standard buffer specified in Table 9-1 has inadequate vegetative cover to protect the wetland from sedimentation, excess nutrients, pollutants or damaging changes in pH, the approval authority, in consultation with a qualified professional, may increase the buffer width twenty-five percent to protect water quality. (For purposes of this section, inadequate buffers lack dense, continuous vegetation spanning the distance specified Table 9-1 for maintenance of water quality, or as modified by Subsection D (1) above).

In lieu of increasing the buffer width, the approval authority may allow implementation of a buffer planting plan. This buffer planting plan shall provide for planting of all bare and sparsely vegetated areas within the portion of the buffer needed to maintain water quality (per Table 9-1 or as modified by Subsection D(1)) with grasses and native shrubs, at densities that will effectively filter/absorb sediment, nutrients and pollutants, as determined by the approval authority. The applicant shall submit a surety consistent with Section 17.15.330 and provide for monitoring and maintenance to ensure survival or replacement of the planted vegetation." Thurston County Critical Areas Ordinance (In Draft), 17.15.950 in part, http://www.co.thurston.wa.us/permitting/.

Planning Resources	**Wetland Identification and Delineation Manuals**: State of Washington Department of Ecology, http://www.ecy.wa.gov/programs/sea/wetlands/index.html. • Wetlands in Washington – Volume 1: A Synthesis of the Science (March 2005, Publication #05-06-006) • Wetlands in Washington – Volume 2: Guidance for Protecting and Managing Wetlands (April 2005, Publication #05-06-008) • Wetland Mitigation in Washington State: Part 1 – Agency Policies and Guidance (Version 1, March 2006, Publication #06-06-011a) • Wetland Mitigation in Washington State: Part 2 – Developing Mitigation Plans (Version 1, March 2006, Publication #06-06-011b)

3.2.6 Large Woody Debris Recruitment. Large woody debris may be the most important structural component of salmonid habitat (May et al. 1996). If a large tree falls within a riparian area (freshwater and estuarine areas), it has the potential to recruit to the channel and influence channel morphology catching smaller trees and branches that would otherwise float away. Benefits include dissipation of energy associated with water flow, streambank protection and stabilization, sediment storage, and in-stream cover and habitat diversity (May et al. 1996). Habitat diversity includes the creation of pools that provide suitable rearing habitat for salmonids where food is plentiful with minimal energy expenditure. These pools also assist in the retention of salmonid carcasses by adding habitat complexity where these carcasses may settle out and add nutrients for stream productivity (Cederholm et al. 2000). Deep pools may also provide cover from predators (Kauffman et al. 2001).

Habitat functions maintained when large woody debris naturally recruits to the stream include habitat structure, flow regime and access.

Additionally, large woody debris provides salmonid habitat functions in marine riparian areas (Envirovision et al. 2007). Large woody debris, such as logs and rootwads, recruited to the marine shoreline provides beach stabilization, increases habitat complexity and facilitates the sorting and accumulation of sediments, including fine-grained substrate in the upper beach important for forage fish spawning grounds.

In some cases, property owners request removal of large woody debris when it poses a safety concern or is perceived to promote bank erosion. Wood is also removed at areas of high recreational use such as boat launches. However, threats posed by LWD can often be alleviated by repositioning the wood within the channel; removal should be a last resort and appropriately mitigated by replacing wood in another location to offset habitat impacts. Safety concerns associated with log jams in popular river systems are a growing concern among recreational kayaking and rafting interests and will need further exploration of suitable resolution. Signage at river or stream boat launches can help educate the public about the habitat benefits and safety risks associated with LWD.

Table 3.2.6: Large Woody Debris Recruitment Management Recommendations

Policy Considerations	• Retain large woody debris in streams and along estuarine and marine shorelines (e.g., within buffer areas or management zones) and maintain long-term recruitment of large woody debris from riparian zones. • Prohibit removal, relocation, or modification of large woody debris in aquatic habitats and adjacent banks except when posing an immediate threat to public safety or critical facilities. Assessments of safety threat posed by LWD should be determined in consultation with a qualified geomorphologist. • Mitigate the movement or removal of large woody debris complexes clearly posing a threat to infrastructure and critical facilities. Mitigation may include placing the wood back into the system at a location where it will not pose an immediate hazard and where the lack of large woody debris has been identified as a problem. If wood is not returned to the system, it should be reserved for use in habitat restoration projects. Mitigation also includes replanting native trees at the site of removal. • Consider the inherent nature of wood to accumulate and move in streams and along estuarine and marine shorelines when planning for new or reconstructed infrastructure should • Prohibit salvage logging (including firewood cutting) from riparian areas, including driftwood removal along shorelines.
Policy Example (Vegetation Retention): *King County should adopt development regulations for vegetated areas along streams, which once supported or could in the future support mature trees, that include buffers of sufficient width to facilitate the growth of mature trees and periodic recruitment of woody vegetation into the water body to support vegetation-related shoreline functions. King County October 2008 Draft Shoreline Master Program, Policy 640.*	
Regulatory Considerations	• Require department review and professional assessment for hazard tree removal to determine if a tree poses a "direct threat to property and life." A habitat management report prepared by a qualified arborist must be submitted that includes a description of existing habitat conditions, explores alternatives to outright removal (such as limbing or crown thinning), assesses tree health for recruiting to the channel, and on-site replanting provisions to mitigate removal impacts. Hazard tree removal within a stream requires a Hydraulic Project Approval permit under Chapter 77.55 RCW from the Washington Department of Fish and Wildlife. • Prohibit new structures at dams or weirs that inhibit the passage of wood. • If LWD poses an immediate threat to public safety or critical facilities, a qualified professional (e.g.,

Table 3.2.6: Large Woody Debris Recruitment Management Recommendations

	arborist/engineer) is to determine the appropriate habitat management recommendations. Threats can often be alleviated by repositioning the debris; removal is a last resort.
Regulatory Example (Hazardous Trees): *To the maximum extent practical…Hazard trees should be retained in aquatic area buffers and either topped or pushed over toward the aquatic area. King County Critical Areas Ordinance, 21A.24.365.* ***Regulatory Example (Hazardous Trees):*** *The county may authorize the limbing, thinning or removal of hazard trees in important habitat areas and associated buffers provided that: c. Snags shall be left in place to provide habitat unless they have a disease that would jeopardize other trees. All trees and branches cut in the important habitat area and buffer shall remain there unless the tree is diseased. Thurston County Critical Areas Ordinance (In Draft), 17.15.870, http://www.co.thurston.wa.us/permitting/.*	
Planning Resources	**Stream Habitat Restoration Guidelines**, Washington State Aquatic Habitat Guidelines Program (2002), *http://wdfw.wa.gov/hab/ahg*.

3.2.7 In-stream Habitat. In addition to large woody debris, other structural components support salmonid life history stages. Certain substrate (e.g., gravel, cobble) in the stream bed provide critical habitat for egg incubation and embryo development. Human influences on water flows can result in excessive scour and aggradations to substrate, diminishing streambed habitat (May et al. 1996).

Habitat functions maintained by in-stream habitat protection include flow regime and access.

Streams with healthy riparian habitats help maintain natural erosion rates along streambanks. Naturally stable stream banks provide refuge habitat for juvenile salmonids during winter flood events, and help control excessive sediment erosion. In contrast, stream banks armored with rock and other hardened material can increase the frequency of over-bank flows and force accelerated erosion on opposite banks, creating the perceived need to armor additional streams banks.

In addition to flow regime, access is impacted when in-stream construction projects, such as stream crossings, channel changes, dredging, pipeline crossing and water diversions (temporary or permanent) alter the bed and flow of water.

Photo 16: In-Stream Habitat

While road crossings using culverts or bridges are designed to provide fish passage, individual projects and particularly cumulative projects impact habitat connectivity (e.g., floodplain fill) and may result in loss of spawning or rearing habitat.[18] Bridges that span the entire high water channel of a stream are far less impacting than culverts, causeways, or bridges with multiple piers.

Impacts to natural channel processes (e.g., sediment transport and supply to the channel as well as access) from channel changes, pipeline crossings and other projects associated with land use and road building emphasize the need for planning to avoid cumulative impacts. In-stream water diversions need to be properly designed to avoid stranding of salmon and managed to avoid impacts to flow regime detrimental to salmonid resources.

[18] Additional recommendations for road crossings are located in section 3.3.7 Road Standards.

Chapter 77.55 RCW grants the authority to the Washington Department of Fish and Wildlife to permit construction projects in state waters that impact fish life. Any person, organization, or government agency proposing to conduct any construction activity that will use, divert, obstruct or change the bed or flow of waters of the state must do so under the terms of a Hydraulic Project Approval (HPA) permit, issued by WDFW. Waters of the state includes all salt and fresh waters waterward of the ordinary high water line and within the territorial boundary of the state (RCW 77.55.011). Although WDFW permits hydraulic projects when the project meets specifications to protect fish life, local governments are in a unique position to adopt complimentary in-stream protection standards to ensure adequate protection of in-stream salmonid habitat. Contact the Washington State Office of Regulatory Assistance, Environmental Permitting, for information about other permits needed for in-stream projects: *http://www.ora.wa.gov/resources/permitting.asp*.

Table 3.2.7: In-stream Habitat Management Recommendations

Policy Considerations	• Retain streambed gravel. • Remove human-made barriers to salmonid migration, such as blocking culverts and tide gates; maintain fish passage throughout the range of anadromous and resident fish species. • Discourage in-stream structures that are not improving habitat functions such as flood control works. • Avoid new road construction at stream and wetland crossings. Measures to prevent new crossings include: investigation of alternative access locations across neighboring properties and use of joint access roads for multiple lots whether developed together or individually. When avoidance cannot be achieved, bridges should be considered before culverts. • Identify and prioritize the repair/replacement of stream crossings that impede salmon passage as part of a local jurisdiction's periodic Transportation Improvement Program. Identify funding and develop a work schedule to remedy problem stream crossings, working cooperatively with responsible parties, whether public or private. • Maintain stream flows and limit effects on aquifers or streams by requiring mitigation. • Limit outdoor irrigation by encouraging landscaping that requires little irrigation (xeri-scaping).
Policy Example (Substrate Retention): *Mining, dredging, or the removal of gravel, fill or similar materials from streams, ground water recharge areas, or other surface water areas shall be strictly controlled to prevent adverse alterations to flow characteristics, siltation and the pollution or disruption of fish passage, spawning beds, or juvenile rearing areas. Pierce County Comprehensive Plan, Water quality 19A.60.050.* ***Policy Example (Flood Control):*** *Non-structural and non-regulatory methods to protect, enhance, and restore shoreline ecological functions and processes and other shoreline resources should be encouraged as an alternative to structural flood control works and in-stream structures. Nonregulatory and non-structural methods may include public facility and resource planning, land or easement acquisition, education, voluntary protection and enhancement projects, or incentive programs. Whatcom County Shoreline Master Program, Flood Control Works and In-stream Structures, 23.100.06.*	
Regulatory Considerations	• Prohibit removal of gravel from the streambed. • Avoid activities including mining, dredging or the removal of gravel, fill or similar materials from freshwater

Table 3.2.7: In-stream Habitat Management Recommendations

	streams and nearshore habitats. When activities cannot be avoided, a habitat management plan, prepared by a qualified professional, is required to minimize impacts to salmonid habitat. • Avoid road crossing culverts in critical salmonid habitat areas, particularly spawning areas. When avoidance is not an option, road-crossing culverts are designed to facilitate upstream fish migration (see planning resources). • Require that any existing crossings which impede fish passage be repaired or replaced during road upgrade or improvement projects, subdivision approvals, building, or site development permit approvals to offset new development impacts. • If crossing cannot be avoided, adopt standards for culvert placement and design as listed in WDFW's Design Manual for Culverts. Culverts and bridges should pass the 100-year flood event plus associated debris. In addition to effects on salmonids, under-sized culverts frequently result in failure and replacing such a crossing twice is more expensive than installing an appropriately sized structure the first time. • Inventory existing fish passage barriers at time of land use application and if mitigation is necessary, correction or removal of fish passage barriers is required.
Regulatory Example (Stream Crossings): *Any private or public road expansion or construction which is proposed and must cross streams classified within this article, shall comply with the following minimum development standards:* *(a) The design of stream crossings shall meet the requirements of the Washington Department of Fish and Wildlife. Fish passage shall be provided if necessary to address manmade obstructions on-site. Other alternatives may be allowed upon a showing that, for the site under review, the alternatives would be less disruptive to the habitat or that the necessary building foundations were not feasible. Submittal of a habitat management plan which demonstrates that the alternatives would not result in significant impacts to the fish and wildlife habitat area (FWHCA) may be required;* *(b) Crossings shall not occur in salmonid spawning areas unless no other reasonable crossing site exists. For new development proposals, if existing crossings are determined to adversely impact salmon spawning or passage areas, new or upgraded crossings shall be located as determined necessary through coordination with the Washington State Department of Fish and Wildlife;* *(c) Bridge piers or abutments shall not be placed either within the floodway or between the ordinary, high water marks unless no other reasonable alternative placement exists;* *(d) All stream crossings shall be designed based on the 100-year projected flood flows, even in non-fish bearing Type Np and*	

Table 3.2.7: In-stream Habitat Management Recommendations

Ns streams. In addition, crossings for Type S and F streams should allow for downstream transport of large woody debris; *(e) Crossings shall serve multiple properties whenever possible; and* *(f) Where there is no reasonable alternative to providing a culvert, the culvert shall be the minimum length necessary to accommodate the permitted activity. Jefferson County Critical Areas Ordinance,18.22.250.* ***Regulatory Example (Stream Restoration):*** *Allowed Uses. Restoration of streams previously piped or channeled into a new or relocation streambed when part of a restoration plan that will result in equal or better habitat and water quality and quantity, and that will not diminish the flow capacity of the stream or other natural stream processes; provided, that the relocation has a state hydraulic project approval and all other applicable permits. Walla Walla County Critical Areas Ordinance, 18.08.620.*	
Planning Resources	**Design of Road Culverts for Fish Passage:** Washington State Aquatic Habitat Guidelines Program (2003), *http://wdfw.wa.gov/hab/ahg/*. **Protecting Nearshore Habitat and Functions in Puget Sound:** Washington State Aquatic Habitat Guidelines Program (Envirovision et al. 2007), *http://wdfw.wa.gov/hab/nearshore_guidelines/*. **In-stream Flow Rules**: State of Washington Department of Ecology, *http://www.ecy.wa.gov/programs/wr/instream-flows/isfrul.html*.

3.2.8 Floodplain Areas. Flooding is a natural event that can have positive influences on salmonid habitat (e.g., recruitment and redistribution of large woody debris and gravels). However, flooding exacerbated by floodplain development including impervious surfaces and man-made flood control structures (such as levees and dikes) can negatively affect salmonid habitat by increasing sediment loads, increasing point and non-point source pollutants, decreasing access to distributary channels and pocket estuaries, and removing in-stream habitat structures such as large woody debris. Floods have their greatest impact to salmonid populations during incubation where they can scour redds (NMFS 2008).

Habitat functions maintained by floodplain protection include water quality, flow regime, habitat structure, food source, and access.

Floodplain areas are the relatively flat, low-lying areas adjacent to the main channel of a river or stream (May 2003) subject to inundation by the base flood (WDCTED 2003). Floodplains areas also include coastal areas adjacent to marine waters and behind dikes and levees such as isolated distributary channels, pocket estuaries and estuarine marsh habitat.

Protecting floodplain areas is becoming more important than ever as natural flooding events may increase in frequency due to climate change. Climate change evidence includes increases in average air and ocean temperatures, widespread melting of snow and glaciers, and rising sea level (IPCC 2007). In the short-term climate change is affecting the frequency and magnitude of storm events, resulting in unpredictable flooding events. In the long-term, sea level is expected to rise, inundating and regularly flooding the lowest lying areas during the daily tide cycle. Sea level rise will shift coastal beaches inland and increase erosion of unstable bluffs, endangering houses and other structures built near the shore or near the bluff edges.Significant erosion can cause coastal inlets to migrate and lagoons to fill, and may undermine the shoreline armoring constructed to protect against shoreline erosion. Low-lying river deltas, port areas, and ocean beach communities on the Long Beach peninsula of Willapa Bay and the Ocean Shores community near Grays Harbor are known to be at risk (Washington State Climate Advisory Team 2007).

Table 3.2.8: Floodplain Areas Management Recommendations

Policy Considerations	• Prohibit new development in the 100-year floodplain. • Prohibit new dikes, levees, tide-gates, floodgates, pump stations, culverts, dams, water diversions, and other alterations to the floodplain, excepting habitat improvements such as a wider culvert for fish passage. • Develop accurate floodplain mapping, using LIDAR mapping and parcel information to help determine local areas of flood hazard. • Develop flood hazard reduction plans and ordinances. • Identify opportunities for and encourage restoration of side channel habitat for salmonids as mitigation for modifying existing floodplain structures where feasible. • Adhere to the *National Marine Fisheries Service Biological Opinion* (NMFS 2008) list of reasonable and prudent alternatives to prevent and/or minimize the degradation of channel and floodplain habitat[19]. Although, the 2008 biological opinion was issued for the Puget Sound region, the recommendations can be applied statewide to protect salmonid habitat. • Increase opportunities for land exchanges that retain or restore floodplain and delta habitats. • Investigate potential local effects of climate change and consider potential for increased floods. • Require that geotechnical reports associated with shoreline bluff safety incorporate climate change influences predicted over the next 100 years.
Policy Example (Flood Hazard Protection): *Protect flood hazard areas from development and uses that compromise the flow, storage and buffering of flood waters, normal channel functions, and fish and wildlife habitat and to minimize flood and river process risk to life and property. Jefferson County Comprehensive Plan Chapter Eight, Environment Element, Goal 11.* ***Policy Example (Flood Hazard Management Plans):*** *In cooperation with other applicable agencies and persons, the County should continue to develop long term, comprehensive flood hazard management plans, such as the Lower Nooksack River Comprehensive*	

[19] NMFS intends that improved land use controls in flood zones to protect salmon will be a prerequisite for remaining eligible for Federal Emergency Management Act (FEMA) flood insurance (NMFS 2008). CAO and SMP updates may provide local governments with an opportunity to implement the improved land use standards within FEMA flood zones that are intended under the NMFS Biological Opinion, and thus ensure that property owners can obtain FEMA flood insurance.

Table 3.2.8: Floodplain Areas Management Recommendations

Flood Hazard Management Plan, to prevent needless flood damage, maintain the natural hydraulic capacity of floodways, and conserve valuable, limited resources such as fish, water, soil, and recreation and scenic areas. Whatcom County Shoreline Master Program, Flood Control Works and Instream Structures, 23.100.06.

Policy Example (Flood Control): *New or expanding development or uses in the shoreline, including subdivision of land, that would likely require structural flood control works within a stream, channel migration zone, or floodway should not be allowed. Whatcom County Shoreline Master Program, Flood Control Works and In-stream Structures, 23.100.06.*

Regulatory Considerations	• Prohibit development in the floodway and 100-year floodplain. • Designate frequently flooded areas. A critical area report using best available science is required to avoid floodplain alteration. • If development within the 100-year floodplain is permitted, subject any loss of floodplain habitat to mitigation sequencing provisions. Additionally, indirect adverse effects of development in the floodplain (effects to stormwater, riparian vegetation, bank stability, channel migration, hyporheic zones, wetlands, etc.) must also be mitigated such that equivalent or better salmonid habitat protection is provided. Use Low Impact Development (LID) methods such as those described in the *Low Impact Development Technical Guidance Manual for Puget Sound* (reduce and disconnect impervious surfaces and retain/restore native vegetation) for permitted development within the 100 year floodplain. • Where feasible, require removal or set back of flood control structures (e.g., dikes, levees, and other hard armoring impacts), particularly those located along the lower reaches of river systems.

Regulatory Example (Flood Storage): *Development proposals and alterations shall not reduce the effective base flood storage volume of the floodplain. A development proposal shall provide compensatory storage if grading or other activity displaces any effective flood storage volume. King County Critical Areas Ordinance, 21A.24.240.*

Regulatory Example (Flood Control): *Flood control works to protect existing development should be permitted only when the primary use being protected is consistent with this Program, and the works can be developed in a manner that is compatible with multiple use of streams and associated resources for the long term, including shoreline ecological functions, fish and wildlife management, and recreation. Whatcom County Shoreline Master Program, Flood Control Works and Instream Structures, 23.100.06.*

Table 3.2.8: Floodplain Areas Management Recommendations

Regulatory Example (Flood Control): *New flood control works are prohibited on estuarine shores, on point and channel bars, and in salmon and trout spawning areas, except for the purpose of fish or wildlife habitat enhancement or restoration. Whatcom County Shoreline Master Program, Flood Control Works and Instream Structures, 23.100.06.*	
Planning Resources	**Biological Opinion on Puget Sound National Flood Insurance Program:** National Marine Fisheries Service (September 22, 2008), *http://www.nwr.noaa.gov/*. **Low Impact Development Technical Guidance Manual for Puget Sound**: Puget Sound Action Team (Hinman 2005), *http://www.psparchives.com/publications/our_work/stormwater/lid/LID_manual2005.pdf*. **Climate Change Streamflow Scenarios:** Climate Impacts Group, University of Washington *http://cses.washington.edu/cig/fpt/ccstreamflowtool/sftscenarios.shtml*.

3.2.9 Channel Migration Zone. Natural flooding conditions are supported when river channels are able to migrate across the floodplain, gradually eroding one bank while depositing sediment along the other. This area, where a stream or river is susceptible to channel erosion and therefore reforming is termed a channel migration zone (CMZ). The CMZ includes lateral, down valley migration, vertical change (aggradation and incision), and avulsions or bend cutoffs. This natural process of a river or stream channel movement creates side channels and off-channel areas that shelter juvenile salmon. A CMZ is different from floodways and floodplains as mapped on Flood Insurance Rate Maps. Floodplains and floodways are focused on inundation, whereas CMZs characterize areas susceptible to channel erosion either within or outside areas prone to flooding (Rappe and Abbe 2003).

Habitat functions maintained by channel migration protection include water quality, flow regime, habitat structure, food source and access.

Most migrating streams move through their alluvial deposits. The term dynamic equilibrium is used to describe an alluvial stream condition where a balance between incoming and outgoing sediment exists. The stream location and channel shape or geometry may change locally but overall deposition and erosion rates are balanced. For example, a stream bend may be in dynamic equilibrium between the erosion rate on the outer bend and the deposition rate on the inner bend or point bar. Consequently, native fish have adapted to the balance of flow conditions and timing of flows and the habitats in the channels (cascades, riffles, runs, pools) and their life histories are tied to such geomorphic and hydrological features.

Natural channel migration provides important habitat functions for salmonids as the water meanders and braids creating side channels and off-channel areas that provide forage, natural cover, rearing and refuge for juvenile salmonids (NMFS 2008). Channel migration also alters habitat structure as water courses erode shoreline vegetation and recruit LWD to the channel. Development and shoreline modifications that result in interference with the process of channel migration may result in a net loss of ecological functions associated with the rivers and streams disrupting off-channel hydrological connections and interfering with recruitment of large woody debris.

Table 3.2.9: Channel Migration Zone Management Recommendations

Policy Considerations	• Delineate channel migrations zones. • Designate channel migration zones as critical areas because they are important fish and wildlife conservation areas. • Minimize adverse impacts in existing channel migration zones by adopting CMZ protection standards. • Discourage new dwelling units or expansion of existing structures within the CMZ. • Limit development and shoreline modifications that would result in interference with the process of channel migration that may result in a net loss of ecological functions associated with the rivers and streams. • Allow no new or expanded channel stabilization projects or other river control structures in the channel migration zone, unless protecting existing essential facilities or increasing habitat through bioengineered restoration. • Encourage the removal or relocation of structures within the channel migration zone to facilitate the natural recovery of channel migration processes that create and maintain salmonid habitat. • Plan for and facilitate removal of artificial restrictions to natural channel migration, restoration of off channel hydrological connections and return river processes to a more natural state where feasible and appropriate.
Policy Example (CMZ Protection): *The county should minimize disruption of long-term stream channel migration processes that allow formation of essential habitat features by prohibiting construction of new structures in channel migration zones and minimizing streambank stabilization. Thurston County Comprehensive Plan Chapter Nine, Environment, Policy D.4.*	
Regulatory Considerations	• Allow no development in CMZ plus 50 feet. Exceptions must be mitigated and not adversely affect water quality, water quantity, flood volumes, flood velocities, spawning substrate, and/or floodplain refugia for listed salmonids. • Allow no fill or disposal of dredge material on shorelands or wetlands within a river's channel migration zones.

Table 3.2.9: Channel Migration Zone Management Recommendations

Regulatory Example (Riparian Buffers): *The Director shall have the authority to increase the width of a stream buffer on a case-by-case basis when such increase is necessary to achieve any of the following…Maintain areas for channel migration. Walla Walla County Critical Areas Ordinance, 18.08.674.* ***Regulatory Example (CMZ Protection):*** *Areas adjacent to critical areas shall be considered to be within the jurisdiction of these requirements and regulations to support the intent of this Chapter and ensure protection of the functions and values of critical areas. Adjacent shall mean any activity located…Within the floodway, floodplain, or channel migration zone; Walla Walla County Critical Areas Ordinance, 18.08.030.*	
Planning Resources	**Channel Migration Assessment:** State of Washington Department of Ecology, *http://www.ecy.wa.gov/programs/sea/sma/cma/index.html*. **Shoreline Master Program Guidelines:** State of Washington Department of Ecology, Chapter 173-26 WAC, *http://www.ecy.wa.gov/programs/sea/sma/guidelines/index.html*.

3.2.10 Landslide Hazard Areas. Steep slopes such as marine bluffs replenish beach substrate which influences the habitat functions salmonids use in nearshore riparian areas. Natural erosion rates of shoreline bluffs provide essential functions by providing beach material ("beach nourishment") and therefore shoreline bluffs should be maintained.

Photo 17: Salmon Beach Landslide, Tacoma

Land use activities, such as timber harvest, impervious surface (including road building), clearing and grading, and cutting into the toe of a slope, can destabilize marine bluffs and increase erosion, causing landslides, and elevating levels of suspended sediments and turbidity. Other land use activities that can accelerate erosion and bluff instability on marine bluffs include irrigating lawns and landscaping, septic system discharges, and disrupted drainages. Designating and protecting landslide hazard areas, such as marine bluffs, is important to maintain salmonid habitat functions in the nearshore environment.

Designating and protecting steep slopes in freshwater habitat areas is also important for salmonid survival. Landslides infrequently occur adjacent to freshwater systems where the landscape is natural. When they do occur in natural systems, they contribute large wood which sorts sediment into suitable spawning gravel and unsuitable fine sediment. In systems that have been managed for timber, agriculture or urban development, landslides deliver sediment to the streams without wood, which smothers spawning gravel.

Habitat functions maintained by landslide hazardous areas protection include water quality, flow regime, habitat structure, food source and access.

Many freshwater riparian hillslope failures that enter stream channels may move considerable distances downstream, removing streamline vegetation and soil. Landslides that reach stream channels can transform into catastrophic debris torrents that can scour headwater channels down to bedrock and create a mass export of sediment and large wood to larger, downstream fish-bearing channels. Although gravel and large woody debris can benefit habitat structure,

highly altered rates of their disturbance and delivery can have negative impacts on whole stream reaches, leading to channel widening, riparian forest degradation, reducing food resources and warming stream temperatures (Cederholm et al. 2000). Human activities that can influence landslides include vegetation removal near and on unstable slopes, cutting into the toe of a slope, altering natural drainage patterns and contributing to surface erosion, and developing within channel migration zones.

Table 3.2.10: Landslide Hazard Areas Management Recommendations

Policy Considerations	• Give special protection to landslide hazard areas that can damage rivers and streams during mass wasting events. • Adopt riparian buffers to retain natural vegetation and prevent development on steep slopes. • Maintain vegetation and control drainage on steep slopes. • Protect marine bluffs to allow natural functions of beach nourishment and avoid elevated levels of suspended sediments and turbidity.
Policy Example (LHA Protection): *The protection of lands where development would pose hazards to health, property, important ecological functions or environmental quality shall be achieved through acquisition, enhancement, incentive programs and appropriate regulations. The following ((natural landscape features)) critical areas are particularly susceptible and should be protected…..Slopes with a grade of 40 percent or more or landslide hazards that cannot be mitigated; King County Comprehensive Plan Chapter Four, Environment, Policy 503.*	
Regulatory Considerations	• Designate and protect marine feeder bluffs as a geologically hazardous area. • Measure buffers on streams with ravines from the edge of the bankfull channel (May 2003). • Prohibit vegetation removal in landslide/geologically hazardous areas, including viewshed clearing. If viewshed pruning is permitted, limbing or crown thinning is in compliance with National Arborist Association pruning standards. • Maintain the top slope of bluffs with native vegetation. • Prohibit the placement of structures on feeder bluffs. Require a geotechnical assessment, reviewed by a third party, for shoreline armoring of feeder bluffs to evaluate problems and analyze potential solutions, including the use of alternative designs (Envirovision et al. 2007). • Prohibit development that alters natural drainage and cuts into the slope, especially the toe. • If modifications must be allowed to prevent an unreasonable hardship on a landowner, require habitat enhancement to protect the integrity, functions, and values of existing anadromous fish habitat (see planning resources for habitat management plan recommendations). Management plans should be prepared by a

Table 3.2.10: Landslide Hazard Areas Management Recommendations

	qualified geologist in consultation with a qualified biologist. • Avoid site development that increases infiltration on unstable and potentially unstable bluffs. Stormwater runoff, both in fresh and marine systems, does not contribute to the erosion of the shoreline. • Require moving structures further back from marine feeder bluffs during redevelopment, provided sufficient land is available. Use smaller lot-line setbacks to accommodate structure relocation where it would protect habitat.
Regulatory Example (Marine Bluff Protection): *Increased marine buffer. The width of the marine buffer shall be increased where there are steep slopes, landslide hazard areas, or inadequate vegetation to protect water quality... Thurston County Critical Areas Ordinance (In Draft), 17.15.830, http://www.co.thurston.wa.us/permitting/.* ***Regulatory Example (Vegetation Retention):*** *Unless otherwise provided in K.C.C. 21A.24.045 or as a necessary part of an allowed alteration, removal of any vegetation from a landslide hazard area or buffer is prohibited; King County Code 21A.24.280.*	
Planning Resources	**Managing Drainage on Coastal Bluffs**: State of Washington Department of Ecology, *http://www.ecy.wa.gov/programs/sea/pubs/95-107/intro.html*. **Puget Sound Landslides:** State of Washington Department of Ecology, *http://www.ecy.wa.gov/programs/sea/landslides/index.html*. **Integrated Streambank Protection Guidelines**: Washington State Aquatic Habitat Guidelines Program (2002), *http://wdfw.wa.gov/hab/ahg/*. **Protecting Nearshore Habitat and Functions in Puget Sound**: Washington State Aquatic Habitat Guidelines Program (Envirovision et al. 2007), *http://wdfw.wa.gov/hab/nearshore_guidelines/*.

3.2.11 Water Quality. Clean, well-oxygenated water is necessary at all stages of life for salmonids to thrive. While climate change may influence water quality over the long-term, most water quality degradation can be attributed to land use development practices. Development removes native vegetation, increases water temperatures, and compromises water quality by causing excessive runoff and stormwater discharge which washes nutrients, contaminants, and toxic materials from impervious surfaces into waterways (R2 Resource Consultants et al. 2000). Though these changes are most noticeable in streams draining highly urbanized watersheds (May et al. 1996), smaller scale development impacts are also important in less urbanized watersheds.

Water quality protection also benefits flow regime, food source and habitat structure.

Other sources of water quality degradation include sewage and septic discharges, direct application of chemicals to tidelands, marine dumping, and airborne contaminants, and mis-application of pesticides and herbicides, all of which introduce toxic substances that may threaten salmonid survival. Aquatic invertebrates (a primary food source for juvenile salmonids) are also strongly affected by water quality.

In addition to chemical properties of water, cool water temperatures are especially important for salmonid survival. As mentioned in section 2.3.2, salmonids thrive at temperatures below 17.5°C (~61°F) (Hicks 2000). Potential conditions leading to elevated water temperatures include loss of shading vegetation, reduced groundwater recharge, and increased nutrient inputs.

Water quantity is another aspect of water quality that supports salmonid habitat functions. As discussed in section 2.3.1, salmonid survival is dependent on adequate stream flow throughout the year. Land use development that alters impervious surface cover, results in stream channelization, or otherwise diverts the natural flow of water can have detrimental consequences for salmonid development through all life stages.

Table 3.2.11: Water Quality Management Recommendations[20]

Policy Considerations	• Identify water quality and hydrologic processes within jurisdictions, including water quantity problems, stream flow issues, important groundwater recharge areas and natural storage areas, and existing pollutant sources. • Maintain or restore the natural sources, storage, delivery, and routing of surface water, groundwater, sediments, and nutrients. • Protect and promote healthy riparian areas, groundwater recharge areas, and natural storage areas. • Classify and map critical aquifer recharge areas. • Develop short and long-term strategies where water quality problems are known to exist. • Develop local ordinances to protect water quality. • Make efficient use of recycled water. • Consider new technologies and planning techniques for wastewater and stormwater treatment that may also benefit salmonids. • Promote low-impact development techniques for all new development and redevelopment (see section 3.2.2 stormwater management recommendations, for more information). • Promote water conservation practices on individual development sites, including water-wise landscaping practices, on-site water reclamation and reuse, as well as rainwater catchment. • Encourage water reclamation and reuse at public wastewater treatment plants to enhance stream flows in water quantity-limited watersheds. • Participate in regional water quality monitoring efforts. • Prohibit pesticide/herbicide use in riparian and wetland buffers. (Include exemptions for noxious weed control State of Washington Department of Ecology-approved activities and pesticides approved by the EPA for use near aquatic systems). • Review and consider planning and development-related recommendations in TMDL (total maximum daily load)

[20] See also Table 3.2.2 Stormwater Runoff Management Recommendations.

Table 3.2.11: Water Quality Management Recommendations[20]

	implementation and local watershed management plans as administered by the State of Washington Department of Ecology pursuant to the Watershed Management Act (Chapter 90.82 RCW). • Adopt a ground water management program designed to protect ground water quality, to ensure ground water quantity, and to provide for efficient management of water resources within a designated ground water management area or subarea and developed pursuant to Chapter 173-100 WAC. • Plan for and implement public sewer and water line extensions in synchrony to prevent alteration of water system balances, particularly in small watersheds where surface waters are fed by shallow groundwater aquifers. Extension of sewer lines into areas on private wells, can lead to the net export of water from a subbasin, reducing downstream surface water flows. • Consider water reclamation and reuse plans that return clean, reclaimed water to streams higher in a watershed for the benefit of in-stream aquatic resources consistent with local multi-stakeholder watershed plans. • Encourage the adoption of water metering to educate watershed residents on water use and conservation measures. • Develop educational programs that promote the use of Low Impact Development principles and practices among developers, builders and homeowners to better manage stormwater and maintain and improve water quality of surface and groundwaters.
Policy Example (Water Quality Protection): *Shoreline uses and modifications should be designed and managed to prevent degradation of water quality and alteration of natural conditions. Whatcom County Shoreline Master Program, Aquatic Shoreline Area, 23.30.11.* ***Policy Example (Water Quality Protection):*** *The location, construction, operation, and maintenance of all shoreline uses and developments should maintain or enhance the quantity and quality of surface and ground water over the long term. Whatcom County Shoreline Master Program, Water Quality and Quantity, 23.90.04.* ***Policy Example (Pollution Prevention):*** *Shoreline use and development should minimize the need for chemical fertilizers, pesticides or other similar chemical treatments to prevent contamination of surface and ground water and/or soils, and adverse effects on shoreline ecological functions and values. Whatcom County Shoreline Master Program, Water Quality and Quantity, 23.90.04.* ***Policy Example (Stream Flow Assessment):*** *The county should determine, based on watershed plans, if there are areas where low*	

Table 3.2.11: Water Quality Management Recommendations[20]

summer stream flows or elevated instream water temperature may, now or in the future, imperil anadromous or native resident fish. If such areas are identified, the county should devise and implement development restrictions and management practices as necessary to sustain the fish. Thurston County Comprehensive Plan Chapter Nine, Environment, Policy B.3.	
Regulatory Considerations	• Require water quality/habitat monitoring when development projects unavoidably impact wetland or stream-riparian habitats. • Require critical area reports prepared by a qualified professional for development projects which have the potential for adverse impacts on surface or ground water quality or quantity. These critical area reports should link to any local water quality assessment available through the State of Washington Department of Ecology or other local agency, and prescribe mitigation and monitoring. • Require Best Management Practices (BMPs) in areas supporting critical salmonid habitat including shorelines and riparian zones, to protect water quality. BMPs include: — Control soil loss and reduce water quality degradation caused by high concentrations of nutrients, animal waste, toxics, and sediment using techniques that prioritize source control over water quality treatment/filtration; — Prevent adverse impacts to surface water and ground water flow, circulation patterns, and to the chemical, physical, and biological characteristics of wetlands; — Protect trees and vegetation designated to be retained during and following site construction; and — Provide, monitor and enforce appropriate standards for proper use of chemical herbicides within critical areas. — Prohibit discharge of pollutants into stormwater systems, and regulate runoff from new development, redevelopment, and construction (see stormwater runoff section 3.2.2). • Adopt provisions to protect the hyporheic zone that contains some portion of surface waters, serves as a filter for nutrients, and maintains water quality (see regulatory consideration in section 3.2.3 riparian areas management recommendations and section 3.2.7 in-stream habitat management recommendations). • Adopt riparian and wetland buffer widths accommodate water quality and aquatic habitat functions as indicated in best available science guidance, including WDFW riparian management recommendations and State of Washington Department of Ecology wetlands management guidance.

Table 3.2.11: Water Quality Management Recommendations[20]

	• Require shoreline modifications are required to be constructed of materials that will not adversely affect water quality or aquatic plants and animals.
Regulatory Example (Hydrogeologic Assessment): *For all proposed activities to be located in a critical aquifer recharge area, a critical area report shall contain a level one hydrogeological assessment. A level two hydrogeologic assessment shall be required for any of the following proposed activities: Any other activity determined by the Director likely to have an adverse impact on ground water quality or quantity or on the recharge of the aquifer. Walla Walla County Critical Areas Ordinance, 18.08.230.* ***Regulatory Example (Pollution Prevention):*** *All materials that may come in contact with water shall be constructed of materials, such as untreated wood, concrete, approved plastic composites or steel, that will not adversely affect water quality or aquatic plants or animals. Materials used for decking or other structural components shall be approved by applicable state agencies for contact with water to avoid discharge of pollutants from wave splash, rain, or runoff. Wood treated with creosote, copper chromium arsenic or pentachlorophenol is prohibited in or above shoreline water bodies. Whatcom County Shoreline Master Program, Water Quality and Quantity, 23.90.04.*	
Planning Resources	**Water Quality:** State of Washington Department of Ecology Temperature Standards and Criteria, *http://www.ecy.wa.gov/programs/wq/swqs/temperature.html*; Frequently Asked Questions about Protecting High Quality Waters in Washington, *http://www.ecy.wa.gov/biblio/0810001.html*; Water Quality Assessments, *http://www.ecy.wa.gov/programs/wq/303d/2008/index.html; and Water Clean-up Plans, http://www.ecy.wa.gov/programs/wq/tmdl/TMDLsbyWria/TMDLbyWria.html.* **Watershed Management Plans:** State of Washington Department of Ecology *http://www.ecy.wa.gov/biblio/watershed.html*. **Protecting Nearshore Habitat and Functions in Puget Sound**: Washington State Aquatic Habitat Guidelines Program (Envirovision et al. 2007), *http://wdfw.wa.gov/hab/nearshore_guidelines/*. **Marine and Estuarine Shoreline Modification Issues and Overwater Structures**: Washington State Aquatic Habitat Guidelines Program White Papers, *http://wdfw.wa.gov/hab/ahg/ahgwhite.htm*. **Septic System Resources:** Puget Sound Partnership, *http://www.psparchives.com/our_work/waste/septics.htm*.

3.3 Additional Regulatory and Programmatic Management Recommendations

3.3.1 Comprehensive Planning. Comprehensive planning is the primary tool to address future land use and the intensity of development across a landscape. Comprehensive planning operates at different scales, from county-wide, to watersheds, to smaller scale planning areas such as sub-areas. At each scale, considering how landscape-level processes are impacting salmonid habitat is important. Comprehensive county-wide planning may inform decisions that need to be made at the watershed scale which in turn informs decisions at the site scale. For example, a watershed with salmonid-bearing streams would receive a land use designation that would ensure zoning densities and impervious surface limits were set at a threshold to avoid impacts such as stream channel enlargement and instability, stream bank erosion and fine sediment production and streambed scour and fine sediment deposition (May 2009). Site-specific development regulations, such as riparian buffers, would be tailored to support impervious surface limits and protect stream channels.

Guidance documents and planning tools available from the Washington Department of Fish and Wildlife and the State of Washington Department of Ecology can assist with this landscape-level approach to understanding how changes to ecosystem processes in different parts of the landscape have "downstream" effects on salmonids.

Watershed Planning Resources:
Chris May's literature review of watershed processes and aquatic resources, http://wdfw.wa.gov/hab/watershed_aquaticreview.htm; Ecology's Landscape Planning page, including information on watershed characterization, http://www.ecy.wa.gov/mitigation/landscapeplan.html; and WDFW's information page on Local Habitat Assessments, http://wdfw.wa.gov/habitat/lha/index.html.
The Puget Sound Partnership has identified watershed assessment as a key tool to prioritizing protection and restoration actions and land use decision-making across the landscape (Action Agenda item A.1.3, http://www.psp.wa.gov/aa_action_agenda.php).

Comprehensive Plans often include several related plans or sections (e.g., Subarea Plan, Wastewater Facilities Plan, Water System Plan, Special Purpose District Plans, etc.) that may be adopted by reference, incorporated within the plan or otherwise guide project management (e.g., Transportation Improvement Programs). Because related plans are developed by a variety of departments, they may not be developed with salmonid habitat protection in mind. To remedy this potential inconsistency, a policy should be established that related plans adopted by reference to the Comprehensive Plan address salmonid habitat protection and restoration priorities as outlined in the Comprehensive Plan.

3.3.2 Zoning. Zoning establishes uses and development intensities across the landscape consistent with the local comprehensive plan. The zoning ordinance includes use districts and densities that set the foundation for all future land use decisions (subdivision, maximum allowable impervious surface, working lands, urban areas, building design, etc.). Therefore, zoning districts have a significant influence on protecting salmonid habitat. Below are several considerations for establishing zoning districts.

- Set densities that are appropriate to salmonid habitat needs within the district and the watershed as a whole. In areas where adjoining local jurisdictions share responsibility to protect the health of a particular watershed, work together to assure that densities are set that reflects the needs of the entire watershed.
- Establish overlay districts to reflect channel migration zones and other biodiversity areas protecting salmonid habitat.
- Limit conditional and special uses in salmonid habitat conservation areas.
- Allow flexible density and lot configuration to protect habitat areas.
- Review rezone proposals in priority salmonid recovery watersheds (as identified in salmon recovery plans) with heightened scrutiny. Ensure rezones give proper consideration to the capacity of the land to support human densities and public infrastructure, while maintaining the productive capacity of salmonid as well as other fish and wildlife habitat.

3.3.3 Subdivision Code. Regulations over the division of land often can influence salmonid habitat protection. Land division impacts critical salmonid habitat because it increases density and creates multiple owners, each with a different idea about how to use their land. For example, adjacent landowners may share the same wetland. One landowner may have retained the natural vegetative buffer and has avoided using any pollutants such as lawn fertilizers. Another neighbor sharing the same wetland system, may have cleared a lawn up to the water's edge and treats their landscaping with heavy chemicals that runoff into the water, therefore diminishing the habitat benefits provided by their neighbor. Examples of provisions to improve management of salmonid habitat conservation areas when subdividing parcels are listed here:

- Avoid subdivision of land that is wholly located within a salmonid habitat area (e.g., riparian or wetland buffers); require mitigation when subdivision cannot be avoided.
- Allow for flexible subdivision design, such as cluster development[21], planned unit development, or conservation subdivisions that set aside habitat conservation areas into reserve tracts with one set of management recommendations. Habitat management plans for open space tracts should provide for long term stewardship.

> ***Subdivision Example (Cluster Development):*** *Skagit County Conservation and Reserve Developments (CaRDs) encourage open space retention of critical areas by providing a density bonus when homes are grouped on smaller lots and large areas of open space are set-aside (Skagit County Code 14.18.300).*

- Allow flexibility in lot size and configuration, including on-site density transfers to protect habitat patches and corridors.
- Encourage developers to locate open space tracts adjacent to other open space and/or contiguous with other protected fish and wildlife habitat corridors.

[21] Incentives for clustering housing do not necessarily require a density bonus. Other incentives may include fast-track permitting or transfer of development rights. Density bonus incentives should be carefully reviewed to ensure the outcome to improve management of salmonid habitat conservation areas.

- Provide agency and public review for all rural subdivisions (e.g., does not exempt large lot segregations from review).

3.3.4 Clearing and Grading Ordinance. Clearing and grading occurs early in the development process and planning and site management choices at this stage can have a major impact on salmonid habitat conservation areas. Impacts to avoid or mitigate include increasing erosion and sedimentation, reducing slope stability, increasing soil compaction, damaging sensitive and critical areas, and disrupting flow regime. Examples planning provisions for clearing and grading are listed below. (For more information see the Washington State Department of Commerce Technical Guidance Document for Clearing and Grading in Western Washington, *http://www.commerce.wa.gov/site/420/default.aspx*.)

- Clearing and grading permits should assess how to manage important habitat patches and connectivity and minimize vegetation disturbance.
- Adopt a clearing and grading ordinance or site alterations ordinance to limit the impacts of sediment-laden runoff to local streams and wetlands. When clearing is essential, encourage the practice of uprooting and retaining whole trees for later use as large woody debris in habitat projects by offering incentives such as fast-track permitting or mitigation credits.
- Avoid clearing and development in riparian zones.
- Limit clearing and grading to that necessary for establishment of the use or development. Clearing and grading should avoid significant adverse impacts and minimize the alteration of the volume, rate or temperature of freshwater flows to or within the habitat area and any buffer.
- Clearing and grading permits should be identified with future actions (as opposed to isolated actions).

3.3.5 Building Code. Building materials and associated construction impacts can also impact salmonid habitat conservation areas. Example provisions to include in the building code are listed here:

- Incorporate Low Impact Development techniques such as "green building" for areas of high fish and wildlife diversity to reduce water use and release of toxins from building materials.
- Include a building setback of at least 15 feet from habitat buffers.

3.3.6 Road Standards. Road development can impact salmonid habitat in a variety of ways including severing connections between streams and adjacent floodplain networks, converting subsurface to surface flow by intercepting groundwater flowpaths and diverting flow to streams, thereby increasing run-off, "flashiness" and erosion. Carnefix and Frissell (2009) summarize many of these impacts in a literature review titled, Aquatic and Other Environmental Impacts of Roads: The Case for Road Density as Indicator of Human Disturbance and Road-Density Reduction as Restoration Target; A Concise Review. This study found that road densities of greater than 1 road per square mile result in highly significant impacts to aquatic resources. In upland areas of influence on salmonid habitat, maintaining low road densities through comprehensive planning and development regulations can help reduce these impacts. But capital projects such as road building and maintenance are often managed by departments separate from departments that plan zoning, critical area ordinance or shoreline master program amendments. Therefore, road design standards can be disconnected from habitat protection priorities.

Below is an example of road standard considerations to protect salmonid habitat protection. Additional recommendations regarding in-stream crossings are listed in Table 3.2.7, In-stream Habitat Management Recommendations.

- Encourage use of Low Impact Development techniques during the site planning and layout phase of a project, particularly in areas of high aquatic species diversity or salmonid-bearing streams. Examples of these techniques include narrower road widths and the use of pervious paving materials.
- Avoid construction in, or clearing of, riparian areas.
- Enhance riparian habitat when it is reasonable to do so while working on adjacent county roads.

Regional Road Maintenance Program:
*The **Regional Road Maintenance ESA Program Guidelines** were developed by several agencies in Washington state to assist local governments in meeting ESA take rules for road maintenance projects and in implementing the program. The National Marine Fisheries Service has approved an ESA 4(d) limit for road maintenance that is carried out in accordance with the program guidelines to conserve listed salmonids. The Regional Road Maintenance ESA Program Guidelines describes physical, structural, and managerial best management practices designed so that when they are used, singularly or in combination, they reduce road maintenance activities' impacts on water and habitat.*

- Control drainage by directing road runoff onto forest floor before reaching a stream.
- Ensure road maintenance practices avoid direct or indirect entry of herbicides or pesticides into aquatic waters. Allow flexible road design in rural areas.
- Petroleum based substances should be prohibited to reduce dust on rural un-paved roads.

3.3.7 Agricultural Activities. Agricultural activities have the potential to preserve important habitat and watershed processes for salmonids, if carefully managed. Some of the potential impacts of agricultural production to avoid include the removal of streamside vegetation, livestock access to waterways, and farm runoff such as chemical and nutrient fertilizers, pesticides, and fine sediments. Non-regulatory approaches to addressing these impacts are highlighted here (see footnote 8 in section 2.4.2 for more information).

- Encourage new agricultural activities follow Best Management Practices that when used collectively provide riparian protection, source control and filtration to prevent contributing pollutants to surface and ground waters to conserve important habitat areas for salmonids while maintaining working lands.

- Work with the Natural Resources Conservation Service, United States Department of Agriculture Farm Service Agency and local Conservation District to discuss Farm Bill and other incentive programs for habitat enhancements on agricultural lands.

> ***Wildlife Habitat Incentives Program (WHIP):***
> *The purpose of this program is to assist landowners who want to establish and improve aquatic or upland wildlife habitat. Projects with declining wildlife species are given priority. WHIP provides assistance to conservation-minded landowners who are unable to meet the specific eligibility requirements of other USDA conservation programs. The NRCS works with the participant to develop a wildlife habitat plan that typically lasts 5 to 10 years. WHIP agreements between generally last from 5 to 10 years. The program provides up to 75% cost sharing. Participants voluntarily limit future use of the land for a period of time, but retain private ownership. An important note regarding salmon conservation: The Salmon Habitat Restoration Initiative is authorized under WHIP in 5 states (Alaska, California, Maine, Oregon, and Washington). Landowners have flexible options for 1 to 15+ year agreements. Projects include riparian restoration, fish passage barriers, restoring gravel spawning beds, and reducing agricultural runoff.*

- Encourage the development of farm management plans to limit animal access to waterways, fence off and concentrate agricultural activities away from streams, wetlands, and riparian areas, and prevent water runoff of farm or animal waste to streams.

> ***Agricultural Activity Example (CREP):*** *The Washington State Conservation Reserve Enhancement Program (CREP) provides incentives to property owners to restore and improve salmon and steelhead habitat on private land by planting native trees, shrubs, and grasses along streams that support salmon or steelhead. The program is jointly managed by the Farm Service Agency and the* ***Washington State Conservation Commission****. Contact your local Conservation District for more information.*

- E
  ncourage vegetation retention and restoration in riparian areas (see

Conservation Reserve Enhancement Program (CREP) cited in the previous example).

3.3.8 Forest Practices. Chapter 76.09 RCW grants the authority to the Washington Department of Natural Resources to permit timber harvest on non-federal public and private forest lands in Washington State. In some counties a transfer of jurisdiction to the local government has occurred for non-commercial forest practices due to the number of forest land conversions (Class IV special permits). These governments include Clark, King, Spokane, Mason, Pierce, and Thurston Counties; and the cities of Port Townsend and Bonney Lake. Other jurisdictions will be taking over this authority in the coming years. More information available at: *http://www.dnr.wa.gov/forestpractices/*.

The ***Forest and Fish Report*** of 1999 recommends adaptive management techniques to improve forest practices affecting water quality and salmonid habitat. To address cumulative impacts to the watershed resulting from forest practices, watershed administrative units were established and a watershed analysis is to be performed based on a physical and biological inventory. Cumulative effects have been defined as "the changes to the environment caused by the interaction of natural ecosystem processes with the effects of two or more forest practices." These changes may be taken to include effects on water quality, wildlife, fish habitat, and other public resources. More information available at:
http://www.dnr.wa.gov/Publications/fp_wsa_manual_toc.pdf.

Local governments administering non-commercial forest practices can influence salmonid habitat protection as follows:

- Follow management recommendations outlined in Forest and Fish Report and Watershed Analysis Manual.
- Adopt forested riparian buffers to reduce the delivery of eroded suspended material to streams. See WDFW Riparian Management Recommendations for more information (Knutson and Naef 1997).
- Follow the same example policy and provisions outlined above under "Special Considerations for Anadromous Fish Resources" (maintaining riparian protection zones, protecting water quality, reducing sediment

input, leaving large woody debris, prohibiting in-stream alterations such as roads and bridges and coordinating mitigation with salmon recovery plans).

- Encourage salmonid habitat protection when forest land is converted to non-forestry use. A county, city, town, or regional government must place a six-year development moratorium on lands converted to non-forestry use (RCW 76.09.060). This moratorium may be lifted if mitigation measures, approved by the jurisdiction, are followed. These mitigation measures could include riparian restoration on potential or known salmonid bearing streams as identified in salmon recovery plans. Local forest land conversion rules must be consistent with critical areas rules.

3.3.9 Rule Exceptions (Exemptions, Reasonable Use Exceptions and Variances). Most codes include standards that allow a landowner to do something they could not otherwise do. Permitting an otherwise unacceptable use on a property will likely fall into one of three categories: exemption (often used to accommodate emergency situations), reasonable use exception (often used to accommodate circumstances when allowed uses would deny a landowner all reasonable use of their property), or variance (often used when special conditions and circumstances exist). Exemptions, reasonable use exceptions, and variances should be used sparingly and only permitted if extraordinary circumstances are shown and the public interest suffers no detrimental effect. Below is a list of recommendations for managing rule exceptions.

- Require a public hearing and public review process for variances and reasonable use exceptions. Regional salmon recovery boards and other watershed organizations can be added to mailing lists for hearing notices, as these groups can provide perspective on how a variance or RUE may relate to local salmon recovery goals or projects.
- Limit exceptions to salmonid habitat protection rules in accordance with Washington State Department of Commerce Critical Areas Assistance Handbook recommendations (WDCTED 2003).
- Use reasonable methods as determined in a habitat management plan prepared by a qualified professional to avoid potential impacts to

salmonid habitat conservation areas consistent with best available science for all rule exceptions.

- Require a Shoreline Variance consistent with Chapter 90.58 RCW for Shoreline Master Program variances requests.
- In situations where a reasonable use or variance cannot be avoided, determine and mitigate cumulative impacts using a habitat management plan prepared by a qualified professional. Mitigation is used to further restoration and protection objectives.

3.3.10 Incentive Programs. Policies can also be adopted that direct county departments to use incentives and flexible approaches to encourage wetland and riparian protection (e.g., proper use of buffer averaging[22], long-term stewardship incentives). Incentives and innovative approaches to salmonid protection and recovery include tax reductions, transfer and purchase of development rights, fee reduction programs, streamlined permitting for stewardship activities, and financial assistance for stewardship activities, to name a few. Example incentive policies are listed here:

- Use transfer of development rights or other easement programs or incentives to encourage retention of appropriate agriculture, forestry, and open space uses of the floodplain and infill of urban lands.

> ***Incentive Program Example (TDR):***
> ***King County Transfer of Development Rights Program***
> *protects habitat for federal listed endangered or threatened species (King County Code 21A.37).*

- Direct mitigation, including off-site and compensatory mitigation, towards critical habitat areas and recovery needs for salmon.

[22] Flexibility in buffer widths is sometimes appropriate for riparian or wetland habitat protection in the developed landscape. Processing buffer reduction/averaging as variances, with a hearing, allows citizens and agencies to be notified about the proposed reduction or averaging and provide comment about potential, unforeseen impacts to fish and wildlife resources. It also allows the buffer reduction or averaging to be reviewed for consistency with best available science.

- Where shorelines have been modified, provide incentives to encourage redevelopment activities to include salmonid habitat restoration.
- Support removal and control of noxious weeds in shoreline areas (consult with local conservation districts for native species for replacement).
- When habitat impacts cannot be mitigated on-site, participate in off-site mitigation programs to prevent habitat loss in a subbasin. Off-site mitigation programs should be limited to the subbasin and be consistent with watershed and salmon recovery plan priorities.

Mitigation Program Example:
*Clark County has developed a **Mitigation Opportunities Project** to provide off-site mitigation when avoidance and on-site mitigation to prevent or reduce development impacts cannot be achieved. Examples of off-site mitigation include voluntary contributions to a cumulative effects fund (in-lieu fee), finding and restoring a site through a mitigation marketplace, or using wetland banking credits. The mitigation marketplace allows landowners to shop for off-site mitigation in the sub basin that matches the characteristics of the on-site impacted parcel. The matching sites must have similar environmental character, meet watershed restoration plan goals, and be registered in the system by a landowner interested in selling, donating, or leasing to other parties looking for mitigation sites.*

- Adopt a Public Benefit Rating System (PBRS) Open Space Tax Program (RCW 84.34.055) to allow property owners a tax incentive to protect critical salmonid habitat on their property.

***Incentive Program Example (PBRS): Thurston County Public Benefit Rating System** offers a tax reduction (50-90%) for 5 acres or more of open space in critical areas*

- Adopt incentives (such as lower or no impact fees, fast track permitting to streamline and simplify the permitting process) for green building,

redevelopment, brownfields development and infill, that would protect or improve salmonid habitat.

- Adopt a Conservation Futures (RCW 84.34.230) tax levy to secure funds for critical salmonid habitat.
- Coordinate with landowner incentive programs (local, state and federal) including Farm Bill and Lead Entity identified restoration sites and other Watershed mitigation and restoration efforts such as watershed characterizations coordinated by the State of Washington Department of Ecology and Local Habitat Assessments coordinated by the Washington Department of Fish and Wildlife. More information on these planning tools is listed below under zoning information.

3.3.11 Outreach Programs. Outreach programs educate the public about the importance of salmonid protection and recovery. They can also be used to educate landowners, realtors and builder and developer organizations about ways they may assist through low impact development practices. Example outreach policies are listed here:

- Build awareness, capacity, and support for stewardship of healthy watersheds and salmonid populations through outreach, partnerships, training, education, community events, and recognition awards; provide technical assistance and encourage stewardship involving builder and developer organizations, landowners, citizens, associations, realtors, community groups, and others.
- Conduct public outreach and education: develop and distribute educational materials, promote active school participation in salmon-related activities, host classes and workshops for citizens and community groups, coordinate volunteer activities, maintain a website containing watershed information.

3.4 Implementation and Monitoring

Once a jurisdiction has adopted policies and provisions to protect and restore salmonid habitat, successful implementation occurs during project review. Experienced, well-trained permit writers and planners will enable the implementation of special considerations to protect anadromous fish resources

and all salmonids. These planners will ensure that exemption, reasonable use exception and variance language is implemented consistently and tied to mitigation to ensure no net loss to salmonid habitat functions. There are numerous opportunities for advanced training in environmental science (such as salmonid ecology, shoreline ecology) and land use (GMA/SMA) for planners. Example training programs include:

- ***Department of Commerce short course on local planning***
- ***State of Washington Department of Ecology Coastal Training Program***
- ***Northwest Environmental Training Center***
- ***Planning Association of Washington***
- ***American Planning Association Conferences***.

Monitoring land use activities (especially mitigation projects), is an important action local governments can take to ensure regulations are succeeding at protecting salmonid habitat. One way to measure the success of salmonid protection programs is to conduct an annual audit of development permits that includes a ground-truth component. The audit can be used to inform adaptive management recommendations to improve the implementation of existing policies and rules.

Monitoring components to consider include:

1) Are regulations achieving no net loss to salmonid habitat protection? If not, why not?
2) How many exemptions, reasonable use exceptions and variances have been granted?
3) What types of development permits were granted exemptions?
4) What are the cumulative impacts associated with these exemptions?
5) Were habitat management plans administered to offset cumulative impacts? Was the result no net loss to salmonid habitat function? If not, why not.
6) Were mitigation measures coordinated with salmonid recovery and watershed management plan priorities?

7) Were mitigation measures enforced? If not, why not? Establishing and funding an enforcement program demonstrates a willingness to defend the policies and regulations adopted and implemented by the local government to protect public natural resources, such as salmonid habitat.

Monitoring Program Examples:

The effectiveness of specific habitat restoration actions is being evaluated in nine ***Intensively Monitored Watersheds****, including the Asotin watershed in southeast Washington. Intensively monitored watershed projects are designed to tie cumulative restoration actions within a basin or watershed to the actual improvement in fish production and carrying capacity.*

The ***San Juan Initiative*** *has evaluated the combined effectiveness of the various existing programs and efforts to manage shoreline development in San Juan County. To identify management program gaps and how to address them, the Initiative completed a report comparing existing shoreline development to permitted development and reviewed a small field sample to assess percent of projects out of compliance with permit conditions.*

As the regional salmon recovery entity for Puget Sound Chinook, the ***Puget Sound Partnership*** *is also working to implement a monitoring and adaptive management strategy within each watershed in Puget Sound.*

In addition to salmonid specific policies and regulations, a local jurisdiction needs to have adequate performance and review procedures in place to make salmonid protection and recovery a reality. The Washington State Department of Commerce has developed example language in the *Critical Areas Assistance Handbook* (WDCTED 2003) that addresses general provisions necessary to ensure enforcement of salmonid specific provisions.

3.5 Conclusion: Protecting a Northwest Icon

Salmonids are an icon of Northwest tribal culture and intertwined in the identity of many communities. They contribute to our economy, inform us of the health of our environment, and are linked to the abundance of other species in both aquatic and terrestrial ecosystems. They sustain fisheries, food distribution and retail jobs to support our economy. They act as an indicator of ecosystem health because just like humans, they need clean water, food, shelter, safety and access to resources to subsist and prosper. They support the existence of many other species such as orca whales and bald eagles and contribute to creating habitat functions both in streams by moving substrate and in riparian zones by fertilizing vegetation with their carcasses.

> *"When we try to pick out anything by itself, we find that it is bound fast, by a thousand invisible cords that cannot be broken, to everything in the universe."*
> *– John Muir*

Local governments, particularly land use planning departments, are in a unique position to restore and protect salmonid habitat and help return these iconic fish to thriving numbers by implementing policies and regulations modeled in this guidance document.

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PHOTO CREDITS

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Photo 15: Natural Wetland Habitat, Bob Zeigler, WDFW
Photo 16: In-Stream Habitat, WDFW Image Gallery
Photo 17: Salmon Beach Landslide, Tacoma, GeoEngineering Extreme Events Project, University of California, Berkeley

APPENDIX A
SALMONID RECOVERY IN WASHINGTON STATE

A.1 Salmonid Recovery Programs

The Salmon Recovery Act (SRA), Engrossed Substitute House Bill 2496 (RCW 77.85), was enacted by the Washington State legislature in 1998 to address the listings of salmon and steelhead runs as threatened or endangered under the federal endangered species act (ESA). The legislative intent was to begin activities required for the recovery of salmonid stocks as soon as possible.

The SRA called for the integration of local and regional activities into a statewide strategy and established a coordinated framework for responding to the salmonid crisis. Provided below is a list of the agencies and programs involved in the statewide strategy to recover salmon. This information is included to help local governments 1) understand the state's approach to recover and protect salmonids, and 2) coordinate restoration and protection priorities with state programs.

Salmon Recovery Funding Board

The SRA created the Salmon Recovery Funding Board (SRFB). The SRFB provides grant funds to protect or restore salmon habitat and assist related activities. (*http://www.rco.wa.gov/srfb/board/board.htm*)

Lead Entities for Salmon Recovery

The SRA provided direction for the development of lead entities (LEs). There are currently 27 lead entity organizations in the state. LEs are a key resource for local governments on salmon recovery activities at the local level. LEs provide local leadership in the development of local salmon recovery strategies based on science and assessments in their local areas. Based on their strategies, LEs identify and sequence habitat projects to be funded by SRFB. LEs compile annual lists of salmon-related habitat projects in their area, and submit projects based on these lists and community needs for funding through the SRFB. LEs develop local salmon recovery strategies (based on science and assessments in their local areas). These strategies serve as the foundation of the recovery planning process. LEs play a critical role in the effective implementation of recovery plans statewide and have a strong voice in each of the regional recovery boards planning processes. (*http://www.rco.wa.gov/srfb/leadentities.htm*)

Regional Recovery Boards

Regional Recovery Boards were established because the ESA requires the federal government to develop recovery plans for listed salmon. Regional recovery organizations prepare a recovery plan that gains regional consensus on measurable fish population results, integrates actions necessary in harvest, habitat, hydropower, and hatcheries, and gains commitments to achieve results. They coordinate a multitude of plans across watersheds into one regional plan and help connect local social, cultural, and economic needs and desires with science and ESA goals. The regional recovery plans are discussed in Chapter One. (*http://www.governor.wa.gov/gsro/regions/recovery.asp*)

Recreation and Conservation Office

The Recreation and Conservation Office (RCO) provides staff support to the SRFB and administers grant funding and contracts, including coordinating the Lead Entity Program and works closely with Regional Recovery Boards. In July 2009, under SHB 2157, the Governor's Salmon Recovery Office (GSRO) was moved to the RCO. The GSRO coordinates and assists in the development, implementation, and revision of regional salmon recovery plans as part of a statewide strategy for salmon recovery. (*http://www.rco.wa.gov/*)

Regional Fisheries Enhancement Groups

In 1989, the legislature authorized the formation of regional fisheries enhancement groups (RFEGs). There are 14 RFEGs throughout the state covering a specific geographic region based on watersheds. These groups have a legislative mandate specific to salmon and steelhead, although salmon is the main focus (RCW 77.95). RFEGs are operated on a strictly nonprofit basis, and seek to maximize the efforts of volunteer and private donations to improve the salmon resource for all citizens of the state. Originally, the groups received most funding through WDFW. However, RFEGs have been applying for and receiving more and more outside funding. (*http://wdfw.wa.gov/volunter/index.htm*)

A.2 WDFW's Role in Salmonid Recovery

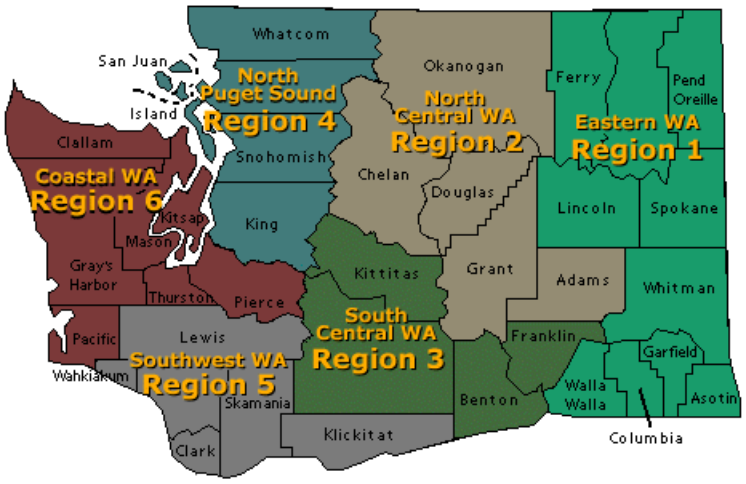
The Washington State Department of Fish and Wildlife (WDFW) is directed to seek resolution to the many conflicts that have critically reduced salmonid resources from their sustainable level; to restore and improve habitat; or identify ways to increase the survival of salmonids (RCW 77.95). WDFW is recognized as

the state leader in providing the science that will make wild salmonid recovery a reality. Over the last decade, WDFW has worked with tribal governments and salmon recovery partners to restore salmonids, provide recreational opportunities, and support economically viable and sustainable fisheries. Harvest management, hatchery reform, hydropower agreements and habitat management technical guidance are some examples of how the Department is achieving wild salmonid recovery. (*http://wdfw.wa.gov/recovery.htm*)

WDFW Technical Assistance

WDFW regional biologists, including Watershed Stewards (WSTs), are available in each of the six regions (shown in Figure A.1) to provide technical assistance to lead entities, RFEGs and the recovery regions to develop and implement the Regional Recovery Plans for federally listed salmon[23]. WSTs work on implementing watershed planning, are the primary WDFW point of contact for public on salmonid recovery issues, and provide a critical link between regional and local recovery efforts. WDFW also provides environmental engineering technical assistance for hydraulic projects. For more information contact WDFW Habitat Program at (360) 902-2534 or visit the website for regional office contact information: *http://wdfw.wa.gov/about/contact/*.

Figure A.1: WDFW Regions



Graphic courtesy of Washington Department of Fish and Wildlife

[23] The Washington Coastal regional recovery plan will go beyond federally listed species. Non-listed species will also be included.

WDFW also has regional staff assigned to provide technical assistance to local governments in the development of rules and regulations to implement salmon recovery plans. Regional staff that work with Growth Management Act, Shoreline Management Act and Priority Habitats and Species are available to provide mapping data to identify salmonid habitat conservation areas and management recommendations to inform policy and rule development. For the most recent contact information for regional staff, please consult the Fish and Wildlife Planner newsletter at: *http://wdfw.wa.gov/hab/fw_planner/index.htm* or contact WDFW Habitat Program at (360) 902-2534.

A.3 Salmonid Protection and Restoration Resources

Habitat Limiting Factors Analysis

The SRA defined a habitat work schedule that included a habitat limiting factors analysis for salmon in streams, rivers, tributaries, estuaries, and subbasins in the region. Between 1998 and 2003, habitat limiting factors analyses were developed for 45 basins in Washington State (Smith 2005). These reports identify habitat factors limiting production of salmonids in waters shared by salmon, steelhead and trout. (*http://www.scc.wa.gov/index.php/174-Salmon-Habitat-Limiting-Factors-Reports/View-category/Page-6.html*)

Habitat Work Schedule (HWS)

HWS is a centralized web-based tool that helps LEs and others interested in salmon recovery, map habitat restoration projects and track the progress of recovery plan implementation. Because the HWS System is centralized and web-based with public access, non-sensitive information is available for anyone to take a local, regional, or statewide view of salmon habitat projects in Washington State. (*http://hws.ekosystem.us/*)

Marine Resources Committees

Marine Resources Committees in several counties (Clallam, Grays Harbor, Island, Jefferson, Pacific, San Juan, Skagit, Snohomish and Whatcom) are doing projects to restore nearshore, intertidal and estuarine habitats, improve shellfish harvest areas, support salmon and bottom fish recovery and identify and carry out protection strategies for marine species and habitats. General MRC information available at: *http://www.nwstraits.org/*. Coastal MRC information available at: *http://wdfw.wa.gov/about/volunteer/mrc/*.

Priority Habitats and Species (PHS) Data

WDFW maintains GIS data that includes anadromous fish distribution throughout the state. PHS also includes potential and documented forage fish habitat, kelp and eelgrass beds, wetlands, and other indicators of salmonid habitat. (*http://wdfw.wa.gov/hab/phspage.htm*)

Puget Sound Nearshore Partnership

In 2001, WDFW partnered with the U.S. Army Corps of Engineers to convene the Puget Sound Nearshore Partnership (PSNP) to build and implement an ecosystem restoration strategy. The PSNP includes state, federal, local, and tribal governments as well as academic scientists, ports, non-profits, industry representatives and citizens. PSNP produces and organizes scientific resources, including a series of *technical reports* that can aid local government decision-making. PSNP developed a *change analysis*, which is a geodatabase created to inform land use analysis and investigate the fundamental causes of ecosystem decline due to human change to natural nearshore processes along Puget Sound's shoreline. PSNP also initiated a *grant program*, the Estuary and Salmon Restoration Program (ESRP) awarded to restoration projects in the nearshore environment. Protection and restoration alternatives are considered in the context of the whole ecosystem. (*http://www.pugetsoundnearshore.org/*)

Puget Sound Partnership

The Puget Sound Partnership is a state agency that also serves as the recovery board for the Puget Sound salmon recovery region. The Partnership works to implement the Puget Sound recovery plan as well as develop and implement actions to restore the health of the Puget Sound. To reach this goal, the Partnership works with citizens, governments, tribes, scientists and businesses and has drafted several resource reports including the Puget Sound Action Agenda, watershed plans, and low impact development management recommendations, to name a few. (*http://www.psp.wa.gov/*)

Salmonscape

Salmonscape is another mapping program maintained by WDFW. This mapping application for the Salmon and Steelhead Habitat Inventory and Assessment Program (SSHIAP) characterizes salmonid habitat conditions and distribution of salmonid stocks in Washington. Data is co-managed by WDFW and the NW Indian Fisheries Commission. Salmonscape includes Fish Bits and SaSI data as well as the

Ecosystem Diagnosis and Treatment (EDT) model establishing restoration and protection priorities within some watersheds.
(*http://wdfw.wa.gov/mapping/salmonscape/index.html*)

Salmon Smart: A Guide to Help People Help Salmon

In 2000, WDFW published this guidance to provide an introduction to salmon recovery projects and activities and an overview of how people can get involved. The document includes management recommendations as well as resources and organizations involved in recovery efforts. Although much of the contact information is outdated, this guidance has useful tips for improving behaviors that degrade salmonid habitat.
(*http://wdfw.wa.gov/outreach/salmon/salmonsmart/*)

SaSI

WDFW maintains the Salmonid Stock Inventory (SaSI), a compilation of data on all wild stocks and a scientific determination of each stock's status as: healthy, depressed, critical, unknown, or extinct. (*http://wdfw.wa.gov/fish/sasi/*)

State of Washington Department of Ecology Shoreline Management Program

The Department of Ecology shoreline management program includes links to several sources of technical assistance including data sets and cataloged shoreline information as well as guidance for implementing the shoreline management act in local shoreline master programs.
(*http://www.ecy.wa.gov/programs/sea/sma/index.html*)

State of Washington Department of Ecology Coastal Zone Atlas

The Coastal Zone Atlas includes aerial photographs of marine shorelines, habitat types, physical features, changes in land cover, etc. near Puget Sound, the outer coast, and the estuarine portion of the Columbia River.
(*http://www.ecy.wa.gov/programs/sea/sma/atlas_home.html*)

Subbasin Planning: Bonneville Power

In 2005 the Northwest Power and Conservation Council completed one of the largest locally led watershed planning efforts of its kind in the United States, an effort that resulted in separate plans for 58 tributary watersheds or mainstem segments of the Columbia River. These subbasin plans were developed collaboratively by state and federal fish and wildlife agencies, Indian tribes, local planning groups, fish recovery boards, and Canadian entities where the plans

address transboundary rivers. Subbasin plans identify priority restoration and protection strategies for habitat and fish and wildlife populations in United States portion of the Columbia River system.
(*http://www.nwcouncil.org/fw/subbasinplanning/Default.htm*)

Bonneville Model Watershed Plans: Asotin, Pataha and Tucannon
In 1991 the local conservation districts in Asotin, Garfield and Columbia Counties worked with the Natural Resource Conservation Service, WDFW, WDOE, Nez Perce Tribe, WCC and most importantly local landowners to develop Model Watershed Plans for Asotin and Pataha Creeks and the Tucannon River. The ***Asotin Creek Model Watershed Plan*** *was completed in 1995 and it was the first salmonid restoration plan completed in the state with emphasis on habitat protection and restoration. It was a comprehensive Ridge-top-to-Ridge-top approach to salmonid restoration. The three watersheds listed above have completed upland BMP's to reduce sedimentation, riparian planting and fencing to help protect stream temperatures and reduce streambank sedimentation, instream habitat projects for resting and rearing salmonids, irrigation efficiency projects that have provided increased flows in some instances and screening of irrigation intakes.*

Washington State Department of Natural Resources Aquatic Resources Program A resource for technical assistance and management of state-owned aquatic lands. The program develops policies and provides technical assistance, and scientific research and resources for the aquatic lands. Technical assistance includes data on kelp and eelgrass beds as well as landscape prioritization identifying protection and restoration priorities specific to listed species.
(*http://www.dnr.wa.gov/AboutDNR/Divisions/ARD/Pages/home.aspx*)

Washington State Department of Natural Resources Forest Practices Application Review System (FPARS) Many local governments rely on the FPARS water type maps to indicate stream type (fish bearing) and location. Caution should be taken when using these maps as they can often underestimate fish habitat in urbanized areas. A site visit should always be conducted to confirm stream type and location. (*http://fortress.wa.gov/dnr/app1/fpars/viewer.htm*)

Washington State Department of Natural Resources Shorezone Inventory

This data covers all of Washington's saltwater shorelines from the Canadian border to the mouth of the Columbia River. It describes the geomorphic and biological resources of the intertidal and nearshore habitats. Features such as eroding cliffs, sand and gravel beaches, sandflats and wetlands are some of the geomorphic forms mapped. Visible macrobiotic, such as wetland grasses, intertidal algae, and subtidal vegetation such as eelgrass or kelp, are also mapped.
(*http://www.dnr.wa.gov/ResearchScience/Topics/AquaticHabitats/Pages/aqr_nrsh_publications.aspx*)

Watershed Management Plans

The Watershed Planning Act (ESHB 2514/RCW 90.82) gives local citizens the opportunity to work with local, state, and tribal governments to write watershed plans for their community's present and future water needs. Developed by Water Resource Inventory Area (WRIA) planning units, plans must include water quality and may include in-stream flows, water quality, storage and fish habitat needs. Plans adopted by county council may then receive funds from the State of Washington Department of Ecology for drafting and implementing a Detailed Implementation Plan. (*http://www.ecy.wa.gov/watershed/index.html*)

A.4 Management Recommendations

WDFW has produced numerous management recommendations that are recognized sources of best available science. These include:

- ***Pacific Salmon and Wildlife – Ecological Contexts, Relationships, and Implications for Management*** (Cederholm et al. 2000). A technical report synthesizing scientific information linking salmon with wildlife species and the broader aquatic and terrestrial habitat functions in which they coexist. (*http://wdfw.wa.gov/hab/salmonwild/*)

- ***Protecting Nearshore Habitat and Functions in Puget Sound: An Interim Guide*** (Envirovision et al. 2007). Science briefs on key nearshore habitats and recommendations for regulating common shoreline modification activities. (*http://wdfw.wa.gov/hab/nearshore_guidelines/*)

- ***Washington State Aquatic Habitat Guidelines Program***. An integrated approach to marine, freshwater, and riparian habitat protection and restoration. Guidelines include a series of white papers and guidance documents related to shoreline protection and restoration. (*http://wdfw.wa.gov/hab/ahg/*)

- ***Watershed Processes and Aquatic Resources: A Literature Review*** (May 2009). A summary of the literature on hydraulically driven processes: the delivery and routing of water, sediment, large and small wood, nutrients and toxicants in natural environments and those altered by human development. (*http://wdfw.wa.gov/hab/phsrecs.htm*)

- ***WDFW Forage Fish Management Recommendations*** (Bargmann 1998). Management plan of forage fish resources and fisheries in Washington State. (*http://wdfw.wa.gov/fish/forage/manage/foragman.pdf*)

- ***WDFW Management Recommendations for Washington's Priority Habitats: Riparian*** (Knutson and Naef 1997). Statewide riparian management recommendations based on the best available science. Nearly 1,500 pieces of literature on the importance of riparian areas to fish and wildlife were evaluated, and land use recommendations designed to accommodate riparian-associated fish and wildlife were developed. These recommendations consolidate existing scientific literature and provide information on the relationship of riparian habitat to fish and wildlife and to adjacent aquatic and upland ecosystems. (*http://wdfw.wa.gov/hab/phsrecs.htm*)

WDFW has also provided consultation on the production of other management recommendations. These include:

- ***Critical Areas Assistance Handbook: Protecting Critical Areas Within the Framework of the Washington Growth Management Act*** (WDCTED 2003). The Washington State Department of Commerce (formerly the Department of Community Trade and Economic Development) published this guidance to provide local governments with model policies and regulations to protect critical areas. The guidance includes recommendation for special consideration for anadromous fish resources. (*http://www.commerce.wa.gov/site/745/default.aspx*)

- ***Examples of Regulatory Language for Nearshore and Marine Shoreline Protection*** (GeoEngineers 2005). This document contains a compilation of examples of existing regulatory language from Puget Sound jurisdictions that define, classify, protect and mitigate the functions, values and processes of the Puget Sound nearshore and marine shorelines. (*http://www.mrsc.org/subjects/environment/criticalpg.aspx*)

- ***Puget Sound Nearshore Partnership Technical Reports***. The Nearshore Partnership is collecting and organizing technical information to maximize the effectiveness of nearshore restoration and protection projects being undertaken now and in the near future around the Puget Sound. (*http://www.pugetsoundnearshore.org./technical_reports.htm*)

- ***Puget Sound Nearshore Project Priorities***. In 2006, WDFW funded a project to evaluate Puget Sound Salmon Recovery Plan actions in the nearshore to assess the consistency between nearshore recovery strategies developed at local and regional scales. The report includes strategies to improve nearshore recovery in each county and associated watershed throughout the Puget Sound. (*http://wdfw.wa.gov/grants/lead_entities/puget_sound_nearshore_project_priorities.pdf*)

- ***State of Washington Alternative Mitigation Policy Guidance for Aquatic Permitting Requirements from the Departments of Ecology and Fish and Wildlife***. The intent of this guidance is to represent consensus on mitigation policy among the disciplines and the agencies responsible for evaluating, approving, implementing and enforcing aquatic resource mitigation. Provides regulators and applicants with watershed ecosystem management recommendations when considering impacts and the use of preservation, mitigation banking, and off-site or out-of-kind mitigation as tools for salmon and watershed recovery. (*http://wdfw.wa.gov/hab/ahg/altmtgtn.pdf*)

- ***State of Washington Department of Ecology Guidance for Protecting and Managing Wetlands: Volume 2*** (Granger et al. 2005). This document is the second part of a two-part document addressing wetlands in Washington and their protection and management. Volume 2 contains guidance

primarily for local governments on protecting and managing wetlands and their functions based on the synthesis of the science in Volume 1. (*http://www.ecy.wa.gov/biblio/0506008.html*)

- ***Statewide Strategy to Recover Salmon*** (GSRO 1999). The goal of the Strategy is to "Restore salmon, steelhead and trout populations to healthy and harvestable levels and improve the habitats on which fish rely." The Strategy was designed as the state's long-term vision or guide for salmon recovery. The section titled "Linking Land Use Decisions and Salmon Recovery" is most applicable to local government planning programs. (*http://www.governor.wa.gov/gsro/publications/strategy/default.asp*)

A.5 Additional Resources

Adopt-a-Stream

The Adopt-A-Stream Foundation Fish & Wildlife Division was created to address degraded stream and wetland ecosystems. Drawing upon the expertise of its members, the team has surveyed multiple watersheds and successfully identified areas of erosion, fish passage barriers, and pollution sources, and other problem areas. The crew has rectified many of the issues found by successfully completing stream and wetland restoration projects. (*http://www.streamkeeper.org/*)

American Rivers

American Rivers is a nonprofit organization working to protect and restore America's rivers for the benefit of people, wildlife, and nature. (*http://www.americanrivers.org/*)

Earth Economics Ecosystem Valuation Program

Natural systems and the services they provide have dollar values. A report titled *"Ecosystem Services Enhanced by Salmon Habitat Conservation in the Green/Duwamish and Central Puget Sound Watershed"* provides a socio-economic analysis on the economic impacts of salmon habitat restoration. The study concludes that implementation of the habitat plan will enhance the economy and quality of life for citizens within WRIA 9 by enhancing natural capital. (*http://www.eartheconomics.org/*)

Long Live the Kings

Long Live the Kings (LLTK) is a nonprofit organization committed to restoring wild salmon to the waters of the Pacific Northwest. LLTK helps those who make decisions about salmon to be successful. This organization pursues projects and partnerships that compel coordinated, scientifically-credible, and transparent changes to harvest, hatchery, and habitat management to protect and restore wild salmon. (*http://www.lltk.org/*)

Municipal Research and Services Center of Washington

The Municipal Research and Services Center (MRSC) mission is "working together for excellence in local government through professional consultation, research and information services." In addition to other functions, this organization provides information on environmental and natural resources issues that relate to Washington cities and counties, including links to governmental agencies and other environment-oriented Web sites.
(*http://www.mrsc.org/subjects/environment/*)

Northwest Indian Fisheries Commission

The Northwest Indian Fisheries Commission (NWIFC) is a support service organization for 20 treaty Indian tribes in western Washington. The commission is composed of representatives from each member tribe. The role of the NWIFC is to assist member tribes in their role as natural resources co-managers. The commission provides direct services to tribes in areas such as biometrics, fish health and salmon management to achieve an economy of scale that makes more efficient use of limited federal funding. The NWIFC also provides a forum for tribes to address shared natural resources management issues and enables the tribes to speak with a unified voice in Washington, D.C.
(*http://www.nwifc.org/*)

People for Puget Sound

People for Puget Sound is a citizens' group established to protect and restore the health of Puget Sound land and waters through education and action.
(*http://www.pugetsound.org/*)

Salmon Safe

Salmon-Safe is an independent nonprofit organization devoted to restoring agricultural and urban watersheds so that salmon can spawn and thrive. (*http://www.salmonsafe.org/*)

Soils for Salmon

Soils for Salmon is a nonprofit organization dedicated to educating builders, developers, landscapers, and local governments in practices that preserve and improve the soil on building sites and protect waterways. (*http://www.soilsforsalmon.org/*)

StreamNet

StreamNet is a cooperative information management and data dissemination project focused on fisheries and aquatic related data and data related services in the Columbia River basin and the Pacific Northwest. A variety of data are provided in tabular format and as maps and GIS layers maintained and disseminated through the Pacific States Marine Fisheries Commission (PSMFC). (*http://www.streamnet.org/*)

Washington Nature Mapping

A biodiversity database and layers of information about birds, mammals, reptiles, amphibians, fish, insects, and plants that provides information about the biological health of an area, a neighborhood, city, county, and state. (*http://depts.washington.edu/natmap/*)

Wild Fish Conservancy

Wild Fish Conservancy (WFC) is a nonprofit conservation organization dedicated to the recovery and conservation of the region's wild-fish ecosystems. Through science, education and advocacy, WFC promotes technically and socially responsible habitat, hatchery and harvest management to better sustain the region's wild-fish heritage. (*http://www.wildfishconservancy.org/*)

Wild Salmon Center

The mission of the Wild Salmon Center is to identify, understand and protect the best wild salmon ecosystems of the Pacific Rim. The Center devises and implements practical strategies, based on the best science, to protect wild salmon ecosystems and their biodiversity. (*http://www.wildsalmoncenter.org/*)

APPENDIX B
DEFINITIONS

Anadromous Fish – Fish that spawn and rear in freshwater and mature in the marine environment. While most Pacific salmonids die after their first spawning, adult char (bull trout), cutthroat trout and steelhead can live for many years, moving in and out of saltwater and spawning each year. The life history of Pacific salmonids contains critical periods of time when these fish are more susceptible to environmental and physical damage than at other times. The life history of salmonids, for example, contains the following stages: upstream migration of adults, spawning, inter-gravel incubation, rearing, smoltification (the time period needed for juveniles to adjust their body functions to live in the marine environment), downstream migration, and ocean rearing to adults (WDCTED 2003).

Anadromous Fish Habitat – Habitat that is used by anadromous fish at any life stage at any time of the year, including potential habitat likely to be used by anadromous fish that could be recovered by restoration or management and includes off-channel habitat (WDCTED 2003).

Alevin – Newly hatched salmon; yolk sac is still attached (Merz et al. 2008).

Benthic – Pertaining to the bottom (of estuaries, rivers, streams, and lakes) (Merz et al. 2008).

Best Available Science – Current scientific information used in the process to designate, protect, or restore critical areas that is derived from a valid scientific process as defined by WAC 365-195-900 through 925. Sources of the best available science are included in Citations of Recommended Sources of Best Available Science for Designating and Protecting Critical Areas published by the Washington State Department of Commerce (WDCTED 2003). Other sources of best available science included the state aquatic habitat guidelines program, WDFW priority, habitats, and species management recommendations, Puget Sound Nearshore Ecosystem Restoration Project, the National Academy of Science Report and the State of Washington Department of Ecology best available wetland science document, to name a few.

Best Management Practices (BMPs) – Conservation practices or systems of practices and management measures that: (A) Control soil loss and reduce water quality degradation caused by high concentrations of nutrients, animal waste, toxics, and sediment; (B) Minimize adverse impacts to surface water and ground water flow and circulation patterns and to the chemical, physical, and biological characteristics of wetlands; (C) Protect trees and vegetation designated to be retained during and following site construction and use native plant species appropriate to the site for re-vegetation of disturbed areas; and (D) Provide standards for proper use of chemical herbicides within critical areas. The [city/county] shall monitor the application of best management practices to ensure that the standards and policies of this Title are adhered to (WDCTED 2003).

Buffer or Buffer Zone – An area that is contiguous to and protects a critical area which is required for the continued maintenance, functioning, and/or structural stability of a critical area (WDCTED 2003).

Channel Migration Zone (CMZ) – The lateral extent of likely movement along a stream or river during the next one-hundred (100) years as determined by evidence of active stream channel movement over the past one-hundred (100) years. Evidence of active movement over the one-hundred (100) year time frame can be inferred from aerial photos or from specific channel and valley bottom characteristics. The time span typically represents the time it takes to grow mature trees that can provide functional large woody debris to streams. A CMZ is not typically present if the valley width is generally less than two (2) bankfull widths, if the stream or river is confined by terraces, no current or historical aerial photographic evidence exists of significant channel movement, and there is no field evidence of secondary channels with recent scour from stream flow or progressive bank erosion at meander bends. Areas separated from the active channel by legally existing artificial channel constraints that limit bank erosion and channel avulsion without hydraulic connections shall not be considered within the CMZ (WDCTED 2003).

Channelized stream – A stream that has been straightened, runs through pipes or revetments, or is otherwise artificially altered from its natural, meandering course (Knutson and Naef 1997).

Chinook – The largest species of the Pacific salmon, also commonly called "King." Adults weigh about 22 pounds (10kg) and are generally 36 inches (91cm) long. Some Chinook can exceed 100 pounds (Merz et al. 2008).

Chum – A species of Pacific salmon. Chum are also referred to as dog salmon because they were commonly dried and used for feeding dog teams during winter. Chum migrate to sea shortly after spawning in lower river systems. Normal/max size is 26 inches (65cm) and 13 pounds (6kg) (Merz et al. 2008).

Coho – A species of Pacific salmon. Coho typically spawn in coastal streams. Historically coho spawned in Idaho, but due to dams are now extinct everywhere but coastal streams. Normal/max size is 30 inches (75cm) and 13 pounds (6kg) (Merz et al. 2008).

Cumulative Impacts or Effects – The combined, incremental effects of human activity on ecological or critical areas functions and values. Cumulative impacts result when the effects of an action are added to or interact with other effects in a particular place and within a particular time. It is the combination of these effects, and any resulting environmental degradation, that should be the focus of cumulative impact analysis and changes to policies and permitting decisions (WDCTED 2003).

Dissolved oxygen (DO) – The amount of oxygen dissolved in a liquid, such as water (Merz et al. 2008).

Drift Cell – Littoral drift, or shore drift, is the process by which beach sediment is moved along the shoreline. Drift results primarily from the oblique approach of wind-generated waves and can therefore change in response to short-term (daily, weekly, or seasonally) shifts in wind direction. Over the long term, however, many shorelines exhibit a single direction of net shore drift. Net shore-drift is determined through geomorphologic analysis of beach sediment patterns and of coastal landforms (State of Washington Department of Ecology, *http://www.ecy.wa.gov/services/GIS/data/shore/driftcells.htm*).

Ecosystem – A biological community made up of land and water and organisms all interacting together (Merz et al. 2008).

Emergence – The time when the fry leave their gravel nest and move into the water column (Merz et al. 2008).

Estuary – A semi-protected coastal body of water where saltwater is measurably diluted with fresh water (Pritchard 1967 within Simenstad et al. 1982).

Evolutionarily Significant Unit (ESU): The smallest biological unit that can be considered to be a species under the Endangered Species Act as administered by the National Marine Fisheries Service (NMFS). A population or population group is considered to be an ESU if 1) it is substantially reproductively isolated from other conspecific population units, and 2) it represents an important component in the evolutionary legacy of the species. USFWS uses a similar term and concept called the distinct population segment (DPS), which is the wording used in the ESA itself. Thus, the ESU is the NMFS' interpretation of a DPS (WDFW 2008).

Fines – Ambiguous definition of small sediment (roughly <6mm diameter) that may clog inter-gravel pores, impacting permeability and hyporheic water quality (Merz et al. 2008). Fine sediment suffocates eggs and entombs alevins.

Fingerling – Salmonids usually at the parr stage of development (Merz et al. 2008).

Flood or Flooding – A general and temporary condition of partial or complete inundation of normally dry land areas from the overflow of inland waters and/or the unusual and rapid accumulation of runoff of surface waters from any source (WDCTED 2003).

Floodplain – The total land area adjoining a river, stream, watercourse, or lake subject to inundation by the base flood (WDCTED 2003).

Floodplain connectivity – Connection of river to floodplain features such as riparian forests, side channels, sloughs and wetlands (Merz et al. 2008).

Floodway – The channel of a river or other watercourse and the adjacent land area that must be reserved in order to discharge the base flood without cumulatively increasing the surface water elevation more than one (1) foot. Also known as the "zero rise floodway" (WDCTED 2003).

Flows – The rate at which a volume of water passes a given point in a stream or river; usually measured in cubic feet per second (cfs) (Merz et al. 2008).

Frequently Flooded Areas – Lands in the floodplain subject to a one percent (1%) or greater chance of flooding in any given year and those lands that provide important flood storage, conveyance, and attenuation functions, as determined by the [director] in accordance with WAC 365-190-080(3). Frequently flooded areas perform important hydrologic functions and may present a risk to persons and property. Classifications of frequently flooded areas include, at a minimum, the 100-year floodplain designations of the Federal Emergency Management Agency and the National Flood Insurance Program (WDCTED 2003).

Fry – Early lifestage of salmonids. Typically juveniles that can swim and catch their own food. Next life stage after alevin, and before smolt. The third freshwater stage of salmonid development; when egg mass is no longer present and fish develops characteristic markings usually within weeks of hatching. Upon reaching 1.25 inches in length, fish are sometimes called “fingerlings” or “parr” (Merz et al. 2008).

Functions and Values – The beneficial roles served by critical areas including, but are not limited to, water quality protection and enhancement; fish and wildlife habitat; food chain support; flood storage, conveyance and attenuation; ground water recharge and discharge; erosion control; wave attenuation; protection from hazards; historical, archaeological, and aesthetic value protection; educational opportunities; and recreation. These beneficial roles are not listed in order of priority. Critical area functions can be used to help set targets (species composition, structure, etc.) for managed areas, including mitigation sites (WDCTED 2003).

Geologically Hazardous Areas – Areas that may not be suited to development consistent with public health, safety, or environmental standards, because of their susceptibility to erosion, sliding, earthquake, or other geological events as designated by WAC 365-190-080(4). Types of geologically hazardous areas include: erosion, landslide, seismic, mine, and volcanic hazards (WDCTED 2003).

Gravel – Round rocks (64- 2mm) within the streambed which are sometimes used by salmonids in the building of a redd (Merz et al. 2008).

Ground Water – Water in a saturated zone or stratum beneath the surface of land or a surface water body (WDCTED 2003). Groundwater in the floodplain is called hyporheic.

Habitat – The sum total of all the living and non-living factors that surround and potentially influence a plant or animal. Most salmonid habitats are described in terms of physical features such as water depth, temperature, velocity or sediment type (Merz et al. 2008).

Habitat Management Plan – A habitat management plan is prepared by a qualified professional and must identify existing conditions and how the management plan will improve habitat functions over existing conditions to ensure no net loss of salmonid habitat functions. A five year monitoring plan must be included.

Homing – The behavior of returning to the stream where an individual salmonid was hatched (Merz et al. 2008).

Hydraulic Project Approval (HPA) – A permit issued by the Washington Department of Fish and Wildlife for modifications to waters of the state in accordance with Chapter 75.20 RCW (WDCTED 2003).

Hyporheic Zone – The saturated substrata beneath a stream or river channel and under the riparian zone where groundwater and surface water mix (May 2003).

Impervious Surface – A hard surface area that either prevents or retards the entry of water into the soil mantle as under natural conditions prior to development or that causes water to run off the surface in greater quantities or at an increased rate of flow from the flow present under natural conditions prior to development. Common impervious surfaces include, but are not limited to, rooftops, walkways, patios, driveways, parking lots or storage areas, concrete or asphalt paving, gravel roads, packed earthen materials, and oiled macadam or other surfaces which similarly impede the natural infiltration of stormwater (WDCTED 2003).

Incubation – The period of time (variable dependent on temperature) from when an egg is fertilized until swim-up (Merz et al. 2008).

Landslide Hazard Areas – Areas that are potentially subject to risk of mass movement due to a combination of geologic landslide resulting from a combination of geologic, topographic, and hydrologic factors. These areas are typically susceptible to landslides because of a combination of factors including: bedrock, soil, slope gradient, slope aspect, geologic structure, ground water, or other factors (WDCTED 2003).

Large Woody Debris – Logs or rootwads typically >1 m in length and >10 cm in diameter. Provide important features that support several salmonid life stages and macroinvertebrate production (Merz et al. 2008).

Littoral zone – The region of land bordering a body of water (Merz et al. 2008).

Migrating – Moving from one place to another to live, mate or breed (Merz et al. 2008).

Mitigation – Avoiding, minimizing, or compensating for adverse critical areas impacts. Mitigation, in the following sequential order of preference, is: (A) Avoiding the impact altogether by not taking a certain action or parts of an action; (B) Minimizing impacts by limiting the degree or magnitude of the action and its implementation, by using appropriate technology, or by taking affirmative steps, such as project redesign, relocation, or timing, to avoid or reduce impacts; (C) Rectifying the impact to wetlands, critical aquifer recharge areas, and habitat conservation areas by repairing, rehabilitating, or restoring the affected environment to the conditions existing at the time of the initiation of the project; (D) Minimizing or eliminating the hazard by restoring or stabilizing the hazard area through engineered or other methods; (E) Reducing or eliminating the impact or hazard over time by preservation and maintenance operations during the life of the action; (F) Compensating for the impact to wetlands, critical aquifer recharge areas, and habitat conservation areas by replacing, enhancing, or providing substitute resources or environments; and (G) Monitoring the hazard or other required mitigation and taking remedial action when necessary. Mitigation for individual actions may include a combination of the above measures (WDCTED 2003).

Natal stream – Stream of birth (Merz et al. 2008).

Native Vegetation – Plant species that are indigenous to the area (WDCTED 2003).

Natural Production: Fish that spawn or rear entirely in the natural environment. These fish maybe the offspring of natural or hatchery production (WDFW 2008).

Natural Stock: Fish that are produced by spawning and rearing in the natural habitat, regardless of parentage (WDFW 2008).

No Net Loss – No net loss means that the impacts of land use and/or development, whether permitted or exempt from permit requirements, be identified and mitigated such that there are no resulting adverse impacts on ecological functions, habitats or processes (Jefferson County Draft SMP, December 2008).

Ordinary High Water Mark (OHWM) – That mark which is found by examining the bed and banks and ascertaining where the presence and action of waters are so common and usual, and so long continued in all ordinary years, that the soil has a character distinct from that of the abutting upland in respect to vegetation (WDCTED 2003).

Parr – Young salmonid with large, oval, dark marks (that may or may not be present) on sides. Parr marks are believed to be used for camouflage. Parr usually live in freshwater for 1 to 2 years. Parr marks usually disappear during the smolting process (Merz et al. 2008).

Pelagic – Of or in the open ocean or open water (Merz et al. 2008).

Pink - A species of Pacific salmon with very large spots on back and large oval block blotches on both lobes of tail. Spawning adults take on a dull gray coloration on back and upper side with a creamy-white color below. Also known as humpbacks or “humpies”, males develop a pronounced hump on backs as they near spawning (Merz et al. 2008). Pink salmon live for only two and a half years.

Pool – A relatively deep, still section in a stream (Merz et al. 2008).

Population: A group of interbreeding salmonids of the same species of hatchery, wild, or unknown parentage that have developed a unique gene pool, that breed

in approximately the same place and time, and whose progeny tend to return and breed in approximately the same place and time. They often, but not always, are separated from another population by genotypic or demographic characteristics (WDFW 2008).

Qualified Professional – A person with experience and training in the pertinent scientific discipline (fisheries, wetland science, freshwater biology, marine biology, or hydrogeology). A qualified professional must have obtained a B.S. or B.A. or equivalent degree in biology, environmental studies, fisheries, geomorphology or related field, two years of related professional work experience, and experience assessing habitat impacts and drafting management recommendations to avoid no net loss (WDCTED 2003).

Rearing habitat – Rivers, streams, estuaries, or nearshore areas where juvenile fish find the food and shelter they need in order to grow (Merz et al. 2008).

Redd – A salmonid nest; dug out of the streambed's gravel by adult female (Merz et al. 2008).

Refugia – Habitat sanctuaries from extreme environmental events (Merz et al. 2008).

Restoration – Measures taken to restore an altered or damaged natural feature including: (A) Active steps taken to restore damaged wetlands, streams, protected habitat, or their buffers to the functioning condition that existed prior to an unauthorized alteration; and (B) Actions performed to reestablish structural and functional characteristics of the critical area that have been lost by alteration, past management activities, or catastrophic events (WDCTED 2003).

Riffle – A shallow gravel area of a stream that is characterized by increased velocities and gradients (Merz et al. 2008). Riffle crests/pool tailouts are where most salmonid spawn.

Riparian Habitat – Areas adjacent to aquatic systems with flowing water that contain elements of both aquatic and terrestrial ecosystems that mutually influence each other. The width of these areas extends to that portion of the terrestrial landscape that directly influences the aquatic ecosystem by providing shade, fine or large woody debris, nutrients, organic and inorganic debris,

terrestrial insects, or habitat for riparian-associated wildlife. Widths are measured from the ordinary high water mark or from the top of bank if the ordinary high water mark cannot be identified. It includes the entire extent of the floodplain and the extent of vegetation adapted to wet conditions as well as adjacent upland plant communities that directly influence the stream system. Riparian habitat areas include those riparian areas severely altered or damaged due to human development activities (WDCTED 2003).

Riparian vegetation – Vegetation that requires the continuous presence of water, or conditions that are more moist than normally found in the area (Knutson and Naef 1997).

Run – (A)The movement of fish inshore or upstream for spawning, usually at a specific time period (e.g., fall-run, spring-run, winter-run) (Merz et al. 2008); or (B) An area of a stream characterized by smooth surface, moderate depth, and moderate current velocity (intermediate between a pool and a riffle).

Salmonid – Fish that belong to the Salmonidae family, including salmon, trout, char, whitefish, grayling, as well as similar Eurasian species (Merz et al. 2008).

Shorelines – All of the water areas of the state as defined in RCW 90.58.030, including reservoirs and their associated shorelands, together with the lands underlying them except: (A) Shorelines of statewide significance; (B) Shorelines on segments of streams upstream of a point where the mean annual flow is twenty cubic feet per second (20 cfps) or less and the wetlands associated with such upstream segments; and (C) Shorelines on lakes less than twenty (20) acres in size and wetlands associated with such small lakes (WDCTED 2003).

Shorelands or Shoreland Areas – Those lands extending landward for two hundred (200) feet in all directions as measured on a horizontal plane from the ordinary high water mark; floodways and contiguous floodplain areas landward two hundred (200) feet from such floodways; and all wetlands and river deltas associated with the streams, lakes, and tidal waters which are subject to the provisions of Chapter 90.58 RCW, Shoreline Management Act (WDCTED 2003).

Smolt – Life stage when young salmonids often migrate downstream from freshwater to saltwater. When parr become smolts, they lose their spots and

turn silvery. Distinct physiological change allows the smolting salmonid to live in saltwater (Merz et al. 2008).

Smoltification – Process of morphological and physiological adjustment that young salmonids of a certain size undergo to live in saltwater. The process includes changes in shape, color and density (Merz et al. 2008).

Sockeye – A species of Pacific salmon also known as the "red" salmon. Dark blue-black back with silvery sides; no distinct spots on backs, dorsal fins, or tails. Spawning adults develop dull, green colored heads with brick red to scarlet bodies. The landlocked version is known as "kokanee" (Merz et al. 2008). Most populations of sockeye include lake or reservoir rearing for at least two years.

Spawn – To bring forth a new generation of salmonid by digging nests in the stream bed and depositing fertilized eggs into them (Merz et al. 2008).

Special Flood Hazard Areas – The land in the floodplain within an area subject to a one percent (1%) or greater chance of flooding in any given year. Designations of special flood hazard areas on flood insurance map(s) always include the letters A or V (WDCTED 2003). Zone A includes areas subject to inundation by the 1-percent-annual-chance flood event and zone V includes areas along coasts subject to inundation by the 1-percent-annual-chance flood event with additional hazards associated with storm-induced waves. Mandatory flood insurance purchase requirements apply in both zones. (FEMA National Flood Insurance Program, *http://www.fema.gov/business/nfip/fhamr.shtm*).

Species, Candidate – Any fish or wildlife species that is native to the State of Washington that will be reviewed by the Washington Department of Fish and Wildlife for possible state listing as endangered, threatened, or sensitive. A species will be considered for candidate listing if evidence suggests its status meets the criteria for endangered, threatened, or sensitive listings. Candidate species will be managed by WDFW, as needed to ensure the long-term survival of populations in Washington (Knutson and Naef 1997).

Species, Endangered – Any fish or wildlife species that is native to the State of Washington that is seriously threatened with extinction throughout all or a significant part of its range (Knutson and Naef 1997). (Federal definition in the

1973 Endangered Species Act available at: *http://www.fws.gov/endangered/whatwedo.html*.)

Species, Sensitive – Any fish or wildlife species that is native to the State of Washington that is vulnerable or declining, and are likely to become endangered or threatened throughout all or a significant part of its range, without cooperative management or the removal of threats (Knutson and Naef 1997).

Species, Threatened – Any fish or wildlife species that is native to the State of Washington that is likely to become endangered within the foreseeable future throughout all or a significant part of its range (Knutson and Naef 1997). (Federal definition in the 1973 Endangered Species Act available at: *http://www.fws.gov/endangered/whatwedo.html*.)

Steelhead – The anadromous form of the rainbow trout. A small percentage are repeat spawners (Merz et al. 2008).

Stock: A group of fish within a species, which is substantially reproductively isolated from other groups of the same species (WDFW 2008).

Turbidity – The measurement of suspended particles within the water column. Turbidity affects the amount of light penetration in the water column and can impair gill functions in fish (Merz et al. 2008).

Urban Growth – "Urban growth" refers to growth that makes intensive use of land for the location of buildings, structures, and impermeable surfaces to such a degree as to be incompatible with the primary use of land for the production of food, other agricultural products, or fiber, or the extraction of mineral resources, rural uses, rural development, and natural resource lands designated pursuant to RCW 36.70A.170 (RCW 36.70A.030 in part).

Velocity – The speed of flowing water (Merz et al. 2008).

Water Resource Inventory Area (WRIA) – One of sixty-two (62) watersheds in the State of Washington, each composed of the drainage areas of a stream or streams, as established in Chapter 173-500 WAC as it existed on January 1, 1997 (WDCTED 2003).

Watercourse – Any portion of a channel, bed, bank, or bottom waterward of the ordinary high water line of waters of the state including areas in which fish may spawn, reside, or through which they may pass, and tributary waters with defined beds or banks, which influence the quality of fish habitat downstream. This definition includes watercourses that flow on an intermittent basis or which fluctuate in level during the year and applies to the entire bed of such watercourse whether or not the water is at peak level. This definition does not include irrigation ditches, canals, stormwater run-off devices, or other entirely artificial watercourses, except where they exist in a natural watercourse that has been altered by humans (WDCTED 2003).

Watershed – The specific land area that drains into a river system or other body of water (Merz et al. 2008).

Wild - A fish stock that is sustained by natural spawning and rearing in the natural habitat, regardless of parentage (includes native) (WDF et al. 1993).

Wetlands – Those areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs, and similar areas. Wetlands do not include those artificial wetlands intentionally created from non-wetland sites, including, but not limited to, irrigation and drainage ditches, grass-lined swales, canals, detention facilities, wastewater treatment facilities, farm ponds, and landscape amenities, or those wetlands created after July 1, 1990, that were unintentionally created as a result of the construction of a road, street, or highway. Wetlands may include those artificial wetlands intentionally created from non-wetland areas to mitigate the conversion of wetlands. For identifying and delineating a wetland, local government shall use the Washington State Wetland Identification and Delineation Manual (WDCTED 2003).

APPENDIX C
STAKEHOLDER REVIEW AND INPUT

Before this document was published, it went through an extensive internal and external review process. It was vetted internally by a WDFW cross-program technical review team (see reviewers listed under "Acknowledgements"), endorsed by the Washington State Aquatic Habitat Guidelines Program (AHG is a multi-state agency group that provides guidance on marine, freshwater, and riparian habitat protection and restoration), and circulated for a 45-day public comment period (June 15 – August 1, 2009). The public comment draft was posted on the WDFW Habitat Program webpage and nearly 700 individuals, including local planners, state agency partners, watershed groups and Indian tribes, were notified directly and invited to review.

During the public comment period, 46 comment letters were received from state agencies, Indian tribes, local government planners, private consultants and non-government interest groups. A comment response matrix was posted on the WDFW Habitat Program webpage summarizing all comments received and WDFW staff response. In general, the comments included requests for more mitigation examples, more sources of best available science, more focus on watershed planning and more specific policy and regulatory recommendations. The final draft incorporated many of these amendments.